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DEPARTMENT OF NATIONAL DEVELOPMENT BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS

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BRICK SHALE AT RAILWAY CROSSING, 3.4 MILES SOUTH-SOUTH-WEST OF BUNGENDORE, N.S.W.

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D.E. Gardner

The information contained in this report has been obtained by the Department of National Development, as part of the policy of the Commonwealth Government, to assist in the exploration and development of mineral resources. It may not be published in any form or used in a company prospectus without the permission in writing of the Director, Bureau of Mineral Resources, Geology and Geophysics.

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Introduction

Shale exposed in a small excavation on the north-western side of a railway crossing, 3.4 miles south-south-west of Bungendore, was inspected early in 1962. Samples supplied by Mr. T. Jaggers were tested, at the Bureau of Mineral Resources Laboratory, Acton, to evaluate their brickmaking properties*. Later in 1962, a composite sample was obtained by the Bureau from four auger holes on an area 900 feet square, south and west of the railway crossing. A representative part of this sample was submitted for preliminary firing tests to the Ceramics Section of the Australian Mineral Development Laboratories, Parkside, South Australia.

The Shale: Occurrence and Description

The shale occurs in steeply dipping beds that strike slightly west of north; it is weathered and is pale grey with a faint pinkish tinge. The powder from ground shale has a slightly unctuous feel. when rubbed between the fingers. Its detrital constituents are almost exclusively argillitic, but it probably contains an appreciable proportion of silt-size particles. In the northern part of the railway cutting shale is interbedded with sandstone; in the southern part shale, free from sandstone, appears to extend several hundred feet south-south-east. The sandstone beds are commonly veined with quartz. In a creek bed about 500 feet south-west of the area augered, shale, identical in appearance with that in the area tested, is virtually free of vein quartz.

Testing at Bureau of Mineral Resources Laboratory

Samples were crushed in a laboratory jaw-crusher to pass 1/10 - inch mesh sieve, and the finos were separated through a 60-mesh sieve.

A mixture consisting of 6 parts of finely crushed shale (particle size smaller than 0.02 inch) and 4 parts of coarse (particle size larger than 0.02 inch and smaller than 0.064 inch) was moistened, enough water being added to enable the material to cohere when pressed in the hand. The moist crushed shale was pressed in a mould to form rectangular briquettes 3 inches x 1½ inches x 1 inch in size; these the burned in a laboratory oven. The oven temperature was raised to firing temperature (see below) in one day and maintained for three days.

After cooling, the briquettes were measured to ascertain shrinkage. They were then weighed; some were soaked in water overnight and re-weighed to determine water absorption. Two briquettes were tested at the Works Department Laboratory, Canberra, for crushing strength. Results of the experimental work are as follows:

^{*} Footnote. "The precise location from which the samples were collected is not known. No responsibility is accepted for the method of sampling; test results given below apply only to the samples submitted".

Sample No.	Firing Temperature (°C)	Linear Shrinkage (per cent)	Water Absorption (per cent)	Crushing Strength lb. 9	
2•1	1100	5	n.d.*	26,000	Pale, pinkish-
2.3	1050	1	n.d.*	13,000	brown colour; smooth surface;
2.4	1050	1	10.7	n.d.*	quite hard
2.6	1000	1	16.4	n.d.*	(sample No. 2.6 not readily scratched with knife); no sign of cracking or warping.

^{*} n.d., not determined.

Auguer Sampling

Augering was done with a Pengo power auger in a small area south and west of the railway crossing. A sketch map attached shows the positions of the auger holes; logs of the holes are given in Appendix I. The area is nearly all covered by soil, and the distribution of shale and sandstone cannot be seen. Four auger holes were drilled at random localities; all entered weathered shale beneath 2 feet of soil and clay, and, in two holes, an additional 4.5 feet of clayey slopewash or colluvium, which locally contains hard fragments of rock and of vein quartz.

Considered in relation to the probable wide band of shale to the south-south-east, along the railway cutting, and the extensive exposure of shale in the creek bed to the south-west, the results of the augering suggest that the area tested consists predominantly of shale, free from interbedded sandstone. To obtain a more accurate assessment of the shale resources, closer augering or costeaning would have to be done. In a preliminary estimate it appears reasonable to assume that two thirds of the area tested consists of workable shale. If so, resources of shale would amount to 20,000 cubic yards per vertical foot. The depth of augering ranged from 6.5 to 12.5 feet; however, experience has shown that shale sufficiently weathered and soft for brickmaking usually extends to depths much greater than can be drilled by the Pengo auger when it is fitted with a large diameter bit. Assuming that a pit could be worked to a depth of 15 feet the quantities of shale in the 900-foot-square area would amount to 300,000 cubic yards.

Preliminary Firing Tests by Australian Mineral Development Laboratories.

About 10 lb. of the material obtained by augering and bulked together as a composite sample, was submitted for preliminary firing tests to the Ceramics Section of the Australian Mineral Development Laboratories. The shale was ground, and samples of it were prepared, from which cylindrical test pieces, 1 inch in diameter and 0.7 inch long, were extruded, without de-airing. The test pieces were fired at temperatures that ranged in 50 degree intervals from 800 to 1200 degrees Centigrade.

The material was found to be somewhat difficult to grind and rather abrasive. This is not characteristic of the shale. The difficulty in grinding is attributed to particles of sandstone and vein quartz from auger hole No. R1 and hard rock-fragments and vein quartz from the colluvium of hole No.R2.

The fired test pieces were intended to provide preliminary information only; the following approximate data were obtained:

Firing Temperature °C	Average Diameter after Firing (inches)	Linear Shrinkage (per cent)	Colour after Firing	Hardness
800	•98	2	Salmon pink	Marked by finger nail
850	•98	2	31 91	(Easily scratched
900	•98	2	11 ti	by knife
950	•97	3	tj it	}
1000	•96	4	tt tt	(
1050	•94	6	Darker salmon pink	Difficult to scratch with knife
1100	•92	8	Buff red	(Not scratched by knife
1150	•90	10	Buff red- brown	\
1200	•88	12	Dark red- brown	1000: incipient vitrification

The figures of linear shrinkage suggest that dry shrinkage is about 2 per cent. Optimum firing temperature is about 1050°C; at this temperature, firing shrinkage is small, the colour a pleasing salmon pink, and hardness is adequate. Above 1100°C firing shrinkage is excessive and the product is undesirably hard.

A sample of the shale in the creek bed a few hundred feet south-west of the area augered was regarded by Australian Mineral Development Laboritories as promising for use in brickmaking and worthy of full-scale investigation.

This shale is identical in appearance with the shale in the area augered except that it is less weathered; the sample submitted was free from the hard fragments obtained during augering.

Conclusions

Quality of Shale

The shale from this deposit yields a pleasing brick over a satisfactory range of firing temperatures. Difficult grinding and undue abrasion of equipment could be avoided by stripping topsoil and colluvium that contains hard fragments. The boundaries of the shale should be determined in order to avoid sandstone beds; this could be started by augering and stripping, and continued by maintaining some supervision of the development of the pit.

Resources.

The information that is available suggests that there are reasonable prospects of obtaining about 300,000 cubic yards of suitable weathered shale from the area that was augered, 900 feet square, south and west of the railway crossing. The shale beds continue beyond the boundaries of this area to the north and south, and presumably at least 500 feet westwards towards the creek bed in which shale is exposed.

-4--Appendix I - Geological Logs of Auger Holes.

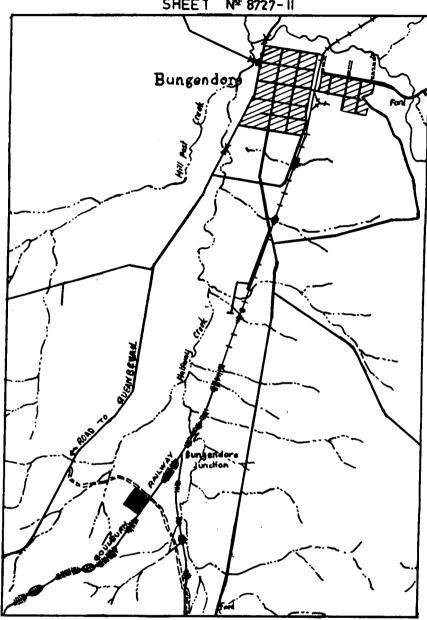
Hole No.	Depth From	(feet) To	Description	Sample
R1	0 1	1 2	Soil; sandstone detritus Clay and soil	
	2	9	Decomposed shale; buff- yellow	R1/1
	9	9•5	Sandy band; some vein quartz. Hard augering	R1/2
R2	0 1	1 2	Sandy soil, with detrital quartz Soil and Clay	
	2	6 . 5	Buff-yellow and white mottled Clay (colluvium); some hard angular fragments of silicified shale and vein quartz.	R2/1
	6 . 5	7	Buff-yellow weathered shale; harder than above. Deflected auger.	
R3	On cr	est of spur	that runs south-west then west from railway Soil	
	11	61	Weathered shale; buff-yellow and pale brown.	R3/1
	6	12•5	Ditto, and grey clay; more decomposed.	
R4	0	1.5	Soil with vein quartz and sandstone fragments	
	1.5	2.5	Soil and clay	
	2.5	6 . 5	White, buff-yellow and cream clay (decomposed shale?).	
	A	t 6.5	Weathered shale.	

LOCALITY MAP.

PLATE 1.

Scale 1 niles.

Traced from Bungendore 1:50,000 sheet.



Reference.

Area shown in Plate 2.

Road.

==== Track .

-+-+ Railway.

... **C**reek.

Embankment.

---- Cutting.

SKETCH MAP BRICK SHALE NEAR RAILWAY GROSSING 3.4 MILES SOUTH - SOUTH - WEST OF BUNGENDORE, N.S.W.

400 FEET. SCALE. 0

REFERENCE.

PLATE 2.

_Railway line Fence and gate. ==== Track. R1 O Auger hole.

R2 0 Band of hard silicified sandstone veined with quartz. ^{R3}0 155/A16/356 TO ACCOMPANY RECORD

BUREAU OF MINERAL RESOURCES, CANBERRA. JUNE 1965.