COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF NATIONAL DEVELOPMENT.

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

RECORDS.

1962/1

NORTH CRACE BRICK SHALE DEPOSIT

by

D.E. Gardner.

NORTH CRACE BRICK SHALE DEPOSIT

by

D.E. Gardner

RECORDS 1962/1

CONTENTS

NORTH CRACE BRICK SHALE DEPOSIT

by

D.E. Gardner

INTRODUCTION

An extensive investigation carried out during 1959 showed that very large resources of brick-making material occur in weathered sedimentary rocks of the Riverside Formation, which forms a belt about a mile wide and more than 5 miles long extending north-westerly past Crace trigonometrical station, at the northern extremity of Canberra City District. An area of about 70 acres, ½ mile north of Crace Trig., was proved by augering and drilling to contain 2,700,000 cubic yards of the weathered sediments down to the level of natural drainage, and 6,000,000 cubic yards down to a depth of 48 feet, which is the lower limit of weathering. The brickmaking properties of the weathered sediments were tested both in the laboratory and at a Sydney brickworks, where high quality bricks were made from bulk samples by routine production methods.

The area tested was termed the "Crace Trig. Brick Shale Deposit". It may be noted in passing that this use of the terms "shale" and "deposit" is somewhat misleading: The Riverside Formation sediments in the area consist not only of shale but also of slaty mudstone, siltstone, very fine sandstone and minor tuffaceous beds; the actual "deposit" of brickmaking material is almost the entire area occupied by the weathered sedimentary rocks; and this amounts to several square miles. However, with due regard to this qualification, it will be convenient to use the term "shale" rather than "weathered sedimentary rocks" and "deposit" rather than "area" or "locality".

The Crace Trig. Deposit has been reserved for Commonwealth Brickworks, Canberra, Ltd., which paid the cost of augering and sampling during the brick shale investigation. With the aim of delineating an area that could be made available to a commercial brick-making company, the North Crace locality has been examined. Accompanying this report are Plate 1, a geological map on a scale of 4 miles to the inch, showing brick shale localities in the northern part of the Australian Capital Territory; Plate 2, a geological map on a scale of 1 mile to 2 inches, showing brick shale localities immediately north of Canberra City District; and Plate 3, a plan of the North Crace Deposit.

INVESTIGATION OF THE DEPOSIT

MAPPING

A rapid plane table survey was made of an area about 3000 feet by 2000 feet, at the southern end of a low, rounded spur that contains scattered outcrops of the weathered Riverside Formation sediments. A minor fault that trends north-north-east forms the western boundary of the area mapped, and a band of hard silicified shale forms the eastern boundary. At the southern end the spur terminates in flat country; from the northern end of the mapped area the spur extends north-eastwards for about 1,500 feet towards Wells Station Homestead.

SAMPLING

A representative sample was taken from scattered outcrops of North Crace brick shale in order to test its brick-making properties by means of trial briquettes. For comparison, the Crace Trig. deposit was also sampled.

The Crace Trig. samples were obtained by chipping channel samples from the upper surface of the weathered shale down to a depth of about 2 feet in a bulldozed pit at the deposit.

The North Crace samples were obtained by shovelling away a few inches of soil at 6 sites scattered throughout the deposit, digging by pick and shovel to depths of 1 to 2 feet, and taking grab samples of the broken material as the digging progressed.

For each deposit, the samples were mixed and quartered down to obtain a representative sample.

LABORATORY TESTING

CRUSHING

The representative samples were crushed in a laboratory jaw-crusher, and sieved to obtain a fine fraction, finer than 0.02 inch mesh size, and a coarse fraction, between 0.02 inch and 0.064 inch mesh sizes.

For each sample, 6 parts by weight of fines was mixed with 4 parts of the coarse fraction to obtain a standard sieved sample of crushed shale for briquette-making.

BRIQUETTE MAKING

The standard sieved sample of crushed shale was moistened sufficiently to enable it to cohere when pressed in the hand. A quantity of the slightly moist material was placed in a steel mould measuring 3" x 1½" x 2", to the full depth (2") of the mould and pressed down to a thickness of 1 inch with a small manually operated hydraulic press.

TABLE

NORTH CRACE BRICK SHALE DEPOSIT

TRIAL BRIQUETTES MADE IN B.M.R. LABORATORY, 19/11/61

Sample No.	Constituents	Weight Before Firing gms	Weight After Firing gms	Water added for moulding	Linear Shrinkage of 3" dimension Total	Linear Shrinkage of 3" dimension Percent	Deposit	Water absorption of burnt briquette (n.d. not determined)	Crushing Strength lbs.
North Crace									
1		170	134.0		.05"	1.7%	North Crace	n.d.	n.d.
2	Shale, weathered shale & clay in	170						n.d.	n.d.
3	ratio of 6 parts	160	126.5		.08"	2.7%	"	15%	n.d.
4	fineground: 4 parts of coarse	150		Approx.				n.d.	n.d.
5	crushed material (Fines being <.02" mesh size, and	150	118.5	17 gms	.07"	2.3%	"	n.d.	15,637
6	coarse between .02" & .064" mesh	150	120.5		.02"	0.7%	"	19.1%	n.d.
7	sizes).	150	121.5		.03"	1.0%	"	n.d.	n.d.
Crace Trig.							Crace		
8		150						n.d.	n.d.
9	Shale, weathered shale & clay in	150	116.5		.07"	2.3%	"	17.6%	n.d.
10	ratio of 6 parts finely ground	150	115.0	Approx.	.09"	3.0%	"	n.d.	n.d.
11	material: 4 parts coarse	150		21 gms			"	n.d.	n.d.
12		150	116.0		.11"	3.7%	"	n.d.	16,724
13		150	117.0		.12"	4.0	"	11.2%	n.d.
14		150	118.0		.10"	3.3%	"	n.d.	n.d.

It was found that in samples 1, 2 and 3 too much material was added to the mould; material in succeeding samples was reduced to 150 gms.

Observations:

Both samples were of smooth even-grained texture and light chocolate colour in green (unfired) state. After firing, all samples were a little warped due no doubt to the fact that in the furnace used the heat was applied from the top only; and Crace samples showed some fine cracks. Shrinkage of North Crace samples was not excessive; they could possibly be fired at higher temperature range than the Crace briquettes. Firing data: Raised from room temperature to 1000°C in approximately 24 hours; kept at 1000°C for 3 days.

FIRING

The briquettes were burned in a laboratory oven. Temperature was slowly raised to 1000°C over a period of about 24 hours, and this temperature was maintained for 3 days.

TESTING OF BRIQUETTES

Shrinkage. This was measured along the 3 inch length.

Water Absorption. Four of the briquettes were immersed in water overnight, and increase in weight determined.

Crushing Strength. Two briquettes were tested at Works Department Laboratory, Barton. Unconfined briquettes were subjected gradually to compression to failure by crushing.

RESULTS

The results of the laboratory work are summarized in Table I. Sound briquettes of a pleasing pale buff-brown colour were obtained from both deposits. The briquettes from the two deposits cannot be distinguished by inspection.

The briquettes show no sign of incipient fusion, and clearly could have been fired at a higher temperature. They are only moderately hard.

Linear shrinkage is low to moderate, ranging from 0.7 to 2.17 percent for the North Crace deposit and 2.3 to 4 percent for the Crace Trig. deposit. Shrinkage would probably have been much higher if the briquettes had been fired at a higher temperature, to increase their hardness.

Water absorption figures are fairly high for both deposits; again indicating the need for an increased firing temperature.

Crushing strength was a little under 16,000 lb for North Crace briquettes and a little over 16,000 lb for Crace Trig. briquettes. This figure is quite satisfactory and would be improved by burning at a higher temperature.

CONCLUSIONS

The briquettes from the two deposits have almost identical appearance and physical properties. It has been shown that the Crace Trig. shale is suitable for commercial brick production, and it is concluded that the North Crace shale would be equally suitable.

POSSIBLE RESERVES

The North Crace deposit has not been tested below the surface and any estimate of reserves must be based on an assumed depth of weathering. Average depth of weathering in three holes drilled in the Crace Trig. deposit is 48 feet. A depth of 30 feet is assumed for the North Crace deposit, and estimated possible reserves are summarized in Table 2. An estimate has been made for a rectangular block that includes the greater part of the low spur in the area mapped, but excludes the main

outcrop of slightly silicified shale. Estimates have been made for a larger block, extending 500 feet eastwards and westwards from the first block. This larger block contains much higher possible reserves, but probably a small quantity of silicified shale would have to be rejected.

NORTH CRACE BRICK SHALE DEPOSIT

Table 2. Estimated Possible Reserves: Based on an assumption that the Depth of Weathering is 30 feet.

Area Covered in Estimate (See Plate 3)	Possible Reserves in Cubic Yards		Remarks
	To level of natural drainage (assumed level 95 feet, Plate 3)	To depth of 30 feet	
Rectangular area 2400 feet by 750 feet	1,800,000*	2,000,000*	
Rectangular area 2400 feet by 1800 feet.		4,800,000*	Probably a small quantity of silicified shale would have to be rejected.

* Based on the assumption that the depth of weathering is 30 feet; depth of weathering has not been tested.

PLATE I

GEOLOGICAL MAP

of Portion of

A.C.T.

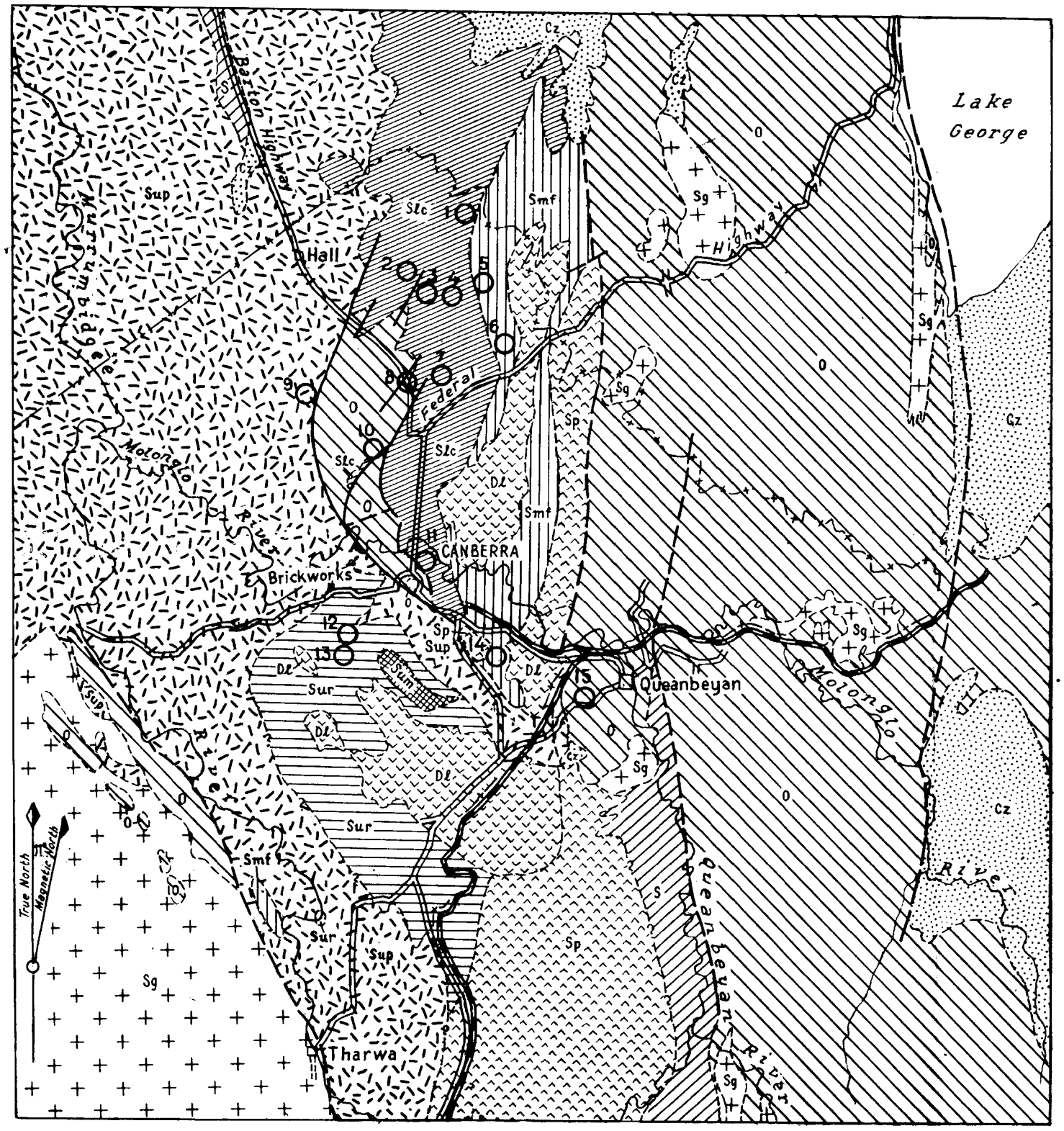
Showing

Brick Shale Localities

SCALE

0 2 4 8

Miles



REFERENCE

1. Mulligan's Flat
2. Sections 6 and 10, Hall District
3. Gundaroo Road
4. Gungaderra deposit
5. Section 13A, Gungahlin District
6. Section 98A, Gungahlin District
7. Crace Trig and North Crace
8. Section 46, Belconnen
9. Belconnen deposit
10. Etheridge Creek deposit
11. Cork Hill deposit
12. Federal deposit
13. Cemetery Road deposit
14. Mahon Hill
15. Queanbeyan deposit

UPPER TERTIARY TO RECENT		Cz	River and lake gravel and alluvium and sand drift. (deposits in Canberra City District are not shown).
LOWER DEVONIAN		Dℓ	Dacite, tuff, quartz porphyry, rhyolite.
UPPER SILURIAN	Mugga Porphyry	+ Sg +	Granite.
		Sum	Intrusive quartz porphyry.
	(Mt. Painter Porphyry)	Sup	Mainly massive quartz porphyry with unmapped sediments.
	Red Hill Group	Sur	(Yarralumla Formation and Deakin Volcanics). Calcareous shale, sandstone, limestone, tuff, porphyry intrusions.
MIDDLE SILURIAN		Sp	Sheared porphyry and tuff. Includes Gladefield Volcanics.
	Fairbairn Group	Smf	Fairbairn Group (includes Mahon Formation, Molonglo River Formation) and St. Johns Beds,. Calcareous shale, limestone, sandstone and volcanics.
LOWER SILURIAN	Canberra Group	Slc	(Camp Hill Sandstone, City Hill Shale, Riverside Formation, Turner Shale). Shale, siltstone, greywacke, limestone, volcanics.
SILURIAN		S	Undifferentiated. Sediments, limestone, volcanics, minor intrusions.
ORDOVICIAN	Upper, Middle and Lower Ordovician not differentiated in this map.	O	(Acton Shale, Muriarra Formation, Pittman Formation, and Black Mt. Sandstone). Siliceous shale, interbedded shale and greywacke, interbedded sandstone shale and mudstone, hard sandstone.

Bureau of Mineral Resources, Geology and Geophysics, Canberra, A.C.T. Jan.1962 to accompany Record 1962/1

A.C.T. G21/1

PLATE 2

GEOLOGICAL MAP OF AREA NORTH OF CANBERRA SHOWING DETAILS OF BRICK SHALE LOCALITIES

BASED ON MAPPING AT PHOTO SCALE BY E.G.WILSON

SCALE

0 ¼ ½ 1 2 Miles

REFERENCE

Recent and Pleistocene	Q	*Alluvium*
Lower Devonian	Dla	*Ainslie Volcanics*
(?) Middle Silurian	Smr	*Sheared porphyry*
	Smr	*Molonglo River Formation*
	Sm	*Not differentiated*
Lower Silurian	Slr	*Riverside Formation*
	Slt	*Turner Shale*
	Sls	*State Circle Shale*
	Sl	*Not differentiated*
Upper Ordovician	Oua	*Acton Shale*
Middle Ordovician	Omp	*Pittman Formation*
(?) Lower Ordovician	Ol	*Black Mountain Sandstone*

Established fault · position accurate

Established fault · position approximate

District boundary. *Fence*

Brick Shale Deposits:-

1. *Mulligan's Flat*
2. *Sections 64 10 Hall District.*
3. *Gundaroo Road*
4. *Gungaderra*
5. *Section 13A Gungahlin District*
6. *Section 98A Gungahlin District*
7. *Crace Trig and North Crace*
8. *Section 46 Belconnen*
9. *Belconnen*

ACT·G21/2

Bureau of Mineral Resources, Geology and Geophysics. Canberra. *Jan. 1962* *to accompany Record 1962/1*

PLATE 3

REFERENCE

Weathered mudstone, siltstone and shale

Shear zone, slightly silicified

100 Surface contour based on assumed datum

Surface contour, position approximate

Fence

Power line

TRUE NORTH

MAGNETIC NORTH

DAM

AREA CONTAINING ESTIMATED 4800000 CUBIC YARDS OF WEATHERED SEDIMENTS

AREA CONTAINING ESTIMATED 2,000,000 CUBIC YARDS OF WEATHERED SEDIMENTS

DAM

Approximate boundary of silicified shale

NORTH CRACE BRICK SHALE DEPOSIT

BLOCK 9 GUNGAHLIN A.C.T.

Scale 0 100 200 Feet

Bureau of Mineral Resources, Geology and Geophysics. Dec. 1961

To accompany Record 1962/1