COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

RECORDS 1969/41

GEOLOGY OF THE CAMP HILL AREA, PARKES A.C.T.

by

G.A.M. Henderson

GEOLOGY OF THE CAMP HILL AREA, PARKES A.C.T.

by

G. A. M. Henderson

Records 1969/41

CONTENTS

SUMMARY

A geological and geophysical investigation of Camp Hill, to assess likely foundation conditions for proposed major buildings, was carried out between April and July, 1968. Bedrock in the area is sandstone and shale which is weathered to depths exceeding 60 feet and locally is extensively crushed and decomposed. Allowable bearing pressures in foundations are expected to be moderate to low, and in places piled foundations may be necessary. The weathered bedrock could be excavated readily by mechanical equipment, and there should be no special problems with groundwater and drainage. No limestone is known in the area.

INTRODUCTION

A request was received from the National Capital Development Commission, in April 1968, for a geological and geophysical investigation of Camp Hill (Fig. 1 and Plate 1), between State Circle and Queen Victoria Terrace, Parkes, A.C.T. The purpose of the investigation was to make an assessment of likely foundation conditions for proposed buildings in the area. Geological mapping was done by plane table at a scale of 1 inch : 100 feet. Two seismic refraction traverses were carried out by the Geophysical Branch of the Bureau (Whitely, 1968). To provide further information on the area five diamond drill holes were put down during July, 1968.

PREVIOUS INVESTIGATIONS

The area was originally mapped by Opik (1958). Some years ago a tunnel for a sewer was excavated below the south side of Queen Victoria Terrace and the geology was mapped by Gardner (1958). A drill hole for the Australian National University was put down in 1964. The hole, between the parking area and Queen Victoria Terrace (see Plate 1), was drilled to a depth of 211 feet. The core is stored at the Department of Geophysics and Geochemistry, Research School of Physical Sciences, Australian National University.

GEOLOGY

The area is underlain by sandstone, siltstone, and shale. The sandstone and siltstone is known as the Camp Hill Sandstone (Opik, 1958) and is the lowermost unit of the Silurian succession in the Canberra area. The shale is part of the State Circle Shale, which conformably overlies the Camp Hill Sandstone.

The sandstone is well exposed in the cutting in State Circle, south of Camp Hill, and was found in drill holes D.D.3 and D.D.C (see Plates 1 and 2 and Appendix). A clayey siltstone, thought to be a fine-grained equivalent of the sandstone, was revealed in part of the sewer tunnel. Two small outcrops of sandstone occur elsewhere in the area and fragments of sandstone are to be found in the soil around the top of the hill.

The sandstone exposed in the State Circle cutting is fine-grained and thinly-bedded. The predominant strike direction of bedding is north-east and dips range from 10 to 30 degrees south-east. The rock is closely jointed; most joints dip steeply. Three minor faults are visible in the road cutting; they are normal faults with downthrow to the east. The bedding is disturbed by dragging at the faults. Weathering in the sandstone and siltstone ranges from moderately to completely weathered. The deepest drill hole in the sandstone, D.D.C, revealed weathering down to 80 feet.

Only one small surface exposure of the shale is known; it is near the southern end of the West Block Government Offices. However, weathered shale, siltstone and claystone were mapped in the sewer tunnel along the south side of Queen Victoria Terrace; the rock was seen to be soft and weak, and decomposed to clay in many places. The A.N.U. drill hole revealed weathering in the shale to a depth of about 130 feet and no fresh shale was found in the later drill holes, the deepest of which (D.D.2) penetrated to a depth of 100 feet. Faulting is common in the shale in the sewer tunnel, particularly near West Block Offices where a broad belt of shearing and crushing probably represents a fault with considerable displacement.

DRILLING RESULTS

The type of drilling equipment employed was an E1000 Mindrill mounted on a trailer. An NMLC core barrel with split inner tube was used to obtain maximum core recovery.

Generally the drilling revealed softer bedrock than was anticipated, especially in the sandstone. The sandstone, which was expected to be at least moderately hard and strong at depth, turned out to be no fresher at depth than the rock exposed in the road cutting in State Circle. Considerable core was lost in many places, indicating zones of clay and very decomposed rock. Much of the rock is extensively broken. There is no indication towards the bottom of any holes of an increase in strength of the rock with depth. On the contrary, two holes (D.D.4 and D.D.C) show a decrease in strength with depth. Possibly these two holes encountered altered bedrock near fault or shear zones. The drill holes in sandstone encountered shale and siltstone interbedded with the sandstone. Coring in bedrock began at

depths ranging from 17 feet in D.D.C to 30 feet in D.D.2 and D.D.4. The material above these depths was too soft to core.

Additional information on the geological structure was obtained from the drill holes. Gardner (1969) has interpreted the structure below Camp Hill to be an anticline; his interpreted boundary between sandstone and shale is shown on Plate 1. However, no direct correlation of individual beds could be made between any of the drill holes. Possibly the contact between sandstone and shale is faulted, at least in part. Further, there may be interfingering of the sandstone, siltstone and shale.

GEOPHYSICAL INVESTIGATIONS

Two seismic refraction traverses were carried out by Whitely (1968) of the Geophysical Branch of the Bureau. The locations of the traverses are shown on Plate 1 and the results on Plate 2.

Three main sub-surface layers are interpreted. The top layer of soil and colluvium ranges in depth from 5 to 10 feet. The material below the top layer appears, from the seismic velocities, to be weathered bedrock. It was hoped that the boundary between sandstone and shale would be indicated but no change in seismic velocity across the contact was recorded. The seismic velocities of the weathered rock in traverse A are significantly higher than those in traverse B. As the two traverses intersect one another it is thought that the variation in seismic velocities may be accounted for by the direction of strike of shear zones. A separation of the weathered layer into two zones occurs at the eastern end of traverse B.

Below the weathered layer fresh bedrock is indicated. However, from the drilling results, the depth to fresh bedrock appears to be greater than that indicated by the seismic results. For example, the depth to fresh bedrock indicated in traverse A near the A.N.U. drill hole is only about 30 feet whereas in the drill hole it is more than 100 feet. The seismic work may possibly have picked up the minimum depth to fresh rock below which there may be a mixture of fresh and weathered rock.

ENGINEERING GEOLOGY

Soil Depths

The word "soil", as used in this report, refers to the unconsolidated material, mainly colluvium that rests on weathered and decomposed bedrock.*

Depths of soil range from one to three feet, where the sandstone is exposed near State Circle, to more than six feet, in the embankment beside West Block. Part of the soil section is also exposed in the embankment flanking Queen Victoria Terrace; the soil there is at least four feet thick. The A.N.U. drill hole revealed 6 feet of soil. No further information on soil depths was obtained from the other drill holes as the highly and completely weathered material immediately below the soil was not cored. The seismic refraction surveys indicate a surface layer with velocities of about 1000 feet/second roughly five to ten feet thick; these velocities are characteristic of soil.

Foundation Conditions

Foundations for buildings in the area will need to be appropriately designed to cope with soft foundation conditions which can be expected at most localities. The sandstone is locally moderately hard and strong, but the rock mass as a whole appears to be soft and weak, with many zones of crushed and decomposed rock. The shale also contains zones of crushed and decomposed rock. A major zone of shearing and crushing, about 90 feet wide and striking about 020 degrees (true bearing), was encountered in the sewer tunnel near the north-western edge of the area; other zones of crushing were also encountered in the sewer tunnel.

The bedrock will probably not support footings with high unit loads at shallow or even moderate depth; in places piled foundations may be necessary. Under the worst conditions, in crushed and decomposed zones, piled foundations will almost certainly be needed. Because of the range of properties which may be encountered over short horizontal distances further testing, including bearing tests, should be carried out at the planning stage for each building site. The undisturbed samples taken by the drilling contractor for laboratory testing, and the penetration tests that were conducted (at 10 feet intervals) in the upper 30 feet of each hole, will provide useful preliminary information.

Excavating Conditions

The softness of the bedrock, as revealed in the drill holes, indicates that bedrock could be excavated readily to the full depth of the drill holes. At the most, only light blasting will be necessary; probably no blasting will be needed in most places. The cutting in State Circle appears to represent a typical example of the excavation conditions to be expected in the

---

* This usage contrasts with engineering usage whereby all earth material having soil-like properties is classified as soil. Decomposed slightly weathered rock is generally soil in the engineering sense.

sandstone. In some places where very weathered zones occur steep slopes and batters may be unstable, particularly where joints, bedding planes, shears and clay seams dip into the excavation.

Groundwater and Drainage

Surface drainage in the area is good since the ground slopes away from the top of the hill towards the extremities of the area. The drill holes were all reported,by the driller, to be dry. Hence, groundwater should present no serious problems during construction and will not require any special provisions in the design of any structures proposed for the area; groundwater should not present problems in excavations.

Sandstone is commonly permeable because of open joints and bedding planes. However the sandstone at Camp Hill contains a high proportion of clay and probably has fairly low permeability. Both weathered shale and fresh shale have low permeability and zones of deep weathering and decomposition to clay are almost impermeable because of the clay present.

CONCLUSIONS

(1) Bedrock in the area is sandstone, siltstone and shale. The likely surface contact between sandstone-siltstone and shale is shown on Plate 1. The contact is probably gradational and may be faulted in places. The general structure is probably anticlinal.

(2) The loading capacity of the weathered bedrock is expected to be moderate to low, especially in crushed and decomposed rock. Locally piled foundations may be necessary. Further testing should be carried out at the planning stage for each building site.

(3) Excavation by mechanical equipment, with little or no blasting, should be possible to the full depth required for buildings as holes drilled to determine foundation conditions showed soft, weathered rock to the full depths of the holes (60 to 100 feet).

(4) No limestone is known in the area and limestone is not expected to occur at depth, hence no special problems such as cavities are anticipated.

(5) Groundwater and drainage should present no special problems.

REFERENCES

GARDNER, D.E., 1958 - Geology of tunnel for sewer main, Queen Victoria Terrace, Parkes, A.C.T. Bur. Miner. Resour. Aust. Drawings (unpubl.).

GARDNER, D.E., 1969 - Geology of the Central Area of Canberra, A.C.T. Bur. Miner. Resour. Aust. Rec. 1969/11.

"
OPIK, A.A., 1958 - The Geology of the Canberra City District. Bur. Miner. Resour. Aust. Bull. 32.

WHITELY, R.J., 1968 - Camp Hill, Canberra, A.C.T., Seismic Survey. Bur. Miner. Resour. Aust. Rec. 1968/128.

APPENDIX 1

GEOLOGICAL LOGS OF DIAMOND DRILL HOLES

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT CAMP HILL SITE INVESTIGATION

LOCATION PARKES, CANBERRA

ANGLE FROM HORIZONTAL 90° DIRECTION

COORDINATES 4940N, 35000E (Stromlo Co-ords.) R.L. 1878' (Approx.)

HOLE NO. D.D.1

SHEET 1 OF 1

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC.	GRAPHIC LOG	DEPTH & SIZE OF CORE	FRACTURE LOG	LIFT & % CORE RECOVERY	CASING	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL	WATER PRESSURE TEST Loss in gallons per minute per foot	COMPRESSIVE STRENGTH	CORE NO.
	OVERBURDEN OF CLAY AND COMPLETELY WEATHERED SHALE NO CORE		20'0"								
SHALE moderately weathered	Pale brown, purple and grey soft, weak rock.		NMLC				Rock extensively broken, contains clay and kaolinitic material				
	Pale brown and grey soft, weak rock. Dark brown iron staining of some bedding planes and concretionary iron staining.		31'0" 41'10"				Several 1"-6" core lengths. Core loss probably kaolinitic material.				
	Strongly laminated purple, pale grey and brown. Iron stained joints. Soft, weak.		45'6" 51'3"				Rock moderately broken				
	Faintly laminated purple pale grey and brown. Iron stained joints. Soft, weak		58'7"				52'10" Broken zone with clay 53'1" 56'5" Mostly clay 57'7" 58'2" Very broken shale 58'7"				
	Brown, slightly greenish. Iron staining on bedding and in other directions irregularly. Soft, weak rock.		70'5"				68'8" Broken shale 69'0"				
	END OF HOLE						70' 5"				

Hole reported dry by driller

DRILL TYPE E1000 Mindrill

FEED

CORE BARREL TYPE Triple tube split inner tube

DRILLER A. Harris

COMMENCED

COMPLETED 3/7/68

LOGGED BY C.A.M. Henderson

VERTICAL SCALE 10 feet: 1 inch

NOTES

FRACTURE LOG:- Number of fractures per foot of core. Zones of core loss are blacked in.

BEDDING AND JOINT PLANES:- Angles are measured relative to a plane normal to the core axis

WATER PRESSURE TESTS

PACKER TYPE

SUPPLY LINE

VERTICAL SCALE

Figures given are gauge pressures. Test sections are indicated graphically by blacked-in strips

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE

COLOUR

To accompany Record 1969/41

I55/A16/568

M(Pf)99

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT CAMP HILL SITE INVESTIGATION

LOCATION PARKES, CANBERRA

ANGLE FROM HORIZONTAL 90° DIRECTION

COORDINATES 4350N, 35800E (Stromlo Co-ords) R.L. 1871' (Approx.)

HOLE NO. D.D.2

SHEET 1 OF 2

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC.	GRAPHIC LOG	DEPTH & SIZE OF CORE	FRACTURE LOG	LIFT & % CORE RECOVERY	CASING	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL	WATER PRESSURE TEST Loss in gallons per minute per foot	CORE RECOVERY	CORE LOSS	CORE RECOVERY %
	OVERBURDEN OF CLAY AND COMPLETELY WEATHERED SHALE NO CORE		30'0"									
SHALE highly weath.	Pale grey and brown, soft, weak rock. Ironstone bands		NMLC 33'0"				Very broken					
SHALE completely weathered	Yellow-brown, very soft and weak rock. Max. core length 3" at 42'6".		35'9" 39'3" 41'0" 44'2" 46'0"				Very broken with much clay	Hole reported dry by driller				
SHALE completely weathered	Pale grey, kaolinitic rock. Very soft and weak. Brown very weathered soft, weak siltstone		47'2" 57'2" 58'0" 60'0" 62'8"				Bedding at 20°					
SHALE highly to completely weathered	Yellow-brown, very soft, weak rock. 2 10" core lengths, others < 6"		70'10" 80'0"				72'3" Core loss in clay zone 77'0" Core loss in clay zone Bedding at 15°					

DRILL TYPE E1000 Mindrill

FEED

CORE BARREL TYPE Triple tube split inner tube

DRILLER A. Harris

COMMENCED

COMPLETED 12/7/68

LOGGED BY G.A.M. Henderson

VERTICAL SCALE 10 feet: 1 inch

NOTES

FRACTURE LOG:- Number of fractures per foot of core. Zones of core loss are blocked in.

BEDDING AND JOINT PLANES:- Angles are measured relative to a plane normal to the core axis

WATER PRESSURE TESTS

PACKER TYPE

SUPPLY LINE

VERTICAL SCALE

Figures given are gauge pressures
Test sections are indicated graphically by blocked-in strips

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE

COLOUR

To accompany Record 1969/41

I55/A16/567(I)

M(Pf)99

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT CAMP HILL SITE INVESTIGATION

LOCATION PARKES, CANBERRA

ANGLE FROM HORIZONTAL 90° DIRECTION

COORDINATES 4450N, 34650E (Stromlo Co-ords) R.L. 1892' (Approx.)

HOLE NO. D.D.3

SHEET 1 OF 1

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC.	GRAPHIC LOG	DEPTH & SIZE OF CORE	FRACTURE LOG	LIFT & % CORE RECOVERY	CASING	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL	WATER PRESSURE TEST Loss in gallons per minute per foot	CORE LOSS (FEET)	PHOTO REF. NOS. (CORE BOARDS)
	OVERBURDEN OF CLAY AND COMPLETELY WEATHERED ROCK NO CORE		25'0"								
SANDSTONE mod. to highly weathered	Pale brown and pale grey, mod. soft and weak rock. Fine grained		NMLC 30'3"				Very broken	Hole reported dry by driller			
SANDSTONE completely weathered	Fine grained, very soft and weak, brown, sandy material.		35'2"								
SANDSTONE moderately weathered	Brown, mod. soft and weak		36'10"								
	Grey, mod. soft and weak		38'5"				Bedding at 15°				
	Red-brown and pale grey mod. soft and weak rock. Fine grained. Max. core length 4", mostly 1"-2". 2" coarse grained interbeds at 53'2" & 54'5". Much of core shows washing away during drilling.		45'11" 54'0"				Bedding at 10°				
			60'2"				Clay zone				
	END OF HOLE						60' 2"				

DRILL TYPE E1000 Mindrill

FEED

CORE BARREL TYPE Triple tube split inner tube

DRILLER A. Harris

COMMENCED

COMPLETED 12/7/68

LOGGED BY G.A.M. Henderson

VERTICAL SCALE 10 feet: 1 inch

NOTES

FRACTURE LOG :- Number of fractures per foot of core. Zones of core loss are blocked in.

BEDDING AND JOINT PLANES :- Angles are measured relative to a plane normal to the core axis

WATER PRESSURE TESTS

PACKER TYPE

SUPPLY LINE

VERTICAL SCALE

Figures given are gauge pressures
Test sections are indicated graphically by blocked-in strips

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE

COLOUR

To accompany Record 1969/41

I55/A16/566

M(Pf)99

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT CAMP HILL SITE INVESTIGATION

LOCATION PARKES, CANBERRA

ANGLE FROM HORIZONTAL 90° DIRECTION

COORDINATES 3850N, 3550OE (Stromlo Co-ords) R.L. 1882'(Approx)

HOLE NO. D.D.4

SHEET 1 OF 1

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC.	GRAPHIC LOG	DEPTH & SIZE OF CORE	FRACTURE LOG	LIFT & % CORE RECOVERY	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL	WATER PRESSURE TEST Loss in gallons per minute per foot	PHOTO CORE BOX	PHOTO CORE BARREL
	OVERBURDEN OF CLAY AND COMPLETELY WEATHERED SHALE NO CORE									
Silty SHALE highly weathered	Yellow-brown, laminated, soft, weak rock. Max. core length 9". Some washing away of core in places.		30'0" NMLC 40'4" 50'4" 51'7"			Bedding at 20° 34'3" Broken zones 35'9" Bedding at 20° 45'6" Broken zone 46'3" Bedding at 20°	Hole reported dry by driller			
SANDSTONE moderately to highly weathered	Yellow-brown, fine grained, moderately soft and weak rock. Max. core length. 5"		60'0"			55'0" Mostly very broken with clay				
Silty SHALE highly weathered	Yellow-brown, laminated, soft, weak rock. Max. core length 5".		60'10" 70'0"			61'0"				
	END OF HOLE					70'0"				

DRILL TYPE E1000 Mindrill

FEED

CORE BARREL TYPE Triple tube, Split inner tube

DRILLER A. Harris

COMMENCED

COMPLETED 22/7/68

LOGGED BY G.A.M. Henderson

VERTICAL SCALE 10 feet : 1 inch

NOTES

FRACTURE LOG :- Number of fractures per foot of core. Zones of core loss are blacked in.

BEDDING AND JOINT PLANES :- Angles are measured relative to a plane normal to the core axis

WATER PRESSURE TESTS

PACKER TYPE

SUPPLY LINE

VERTICAL SCALE

Figures given are gauge pressures
Test sections are indicated graphically by blacked-in strips

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE

COLOUR

To accompany Record 1969/41

I 55/A16/565

M(Pf)99

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT CAMP HILL SITE INVESTIGATION

LOCATION PARKES, CANBERRA

ANGLE FROM HORIZONTAL 90° DIRECTION

COORDINATES 4350N, 35300E (Stromlo Co-ords) R.L. 1913' (Approx.)

HOLE NO. D.D.C

SHEET 1 OF 1

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC.	GRAPHIC LOG	DEPTH & SIZE OF CORE	FRACTURE LOG	LIFT & % CORE RECOVERY	CASING	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL	WATER PRESSURE TEST Loss in gallons per minute per foot	CORE BOX NO.	CORE SAMPLES NO.
	OVERBURDEN OF CLAY AND COMPLETELY WEATHERED ROCK NO CORE		17'0"								
SHALE highly weath.	Pale grey to brown, laminated, very soft weak rock		NMLC 22'0"				Very broken				
S.S. & SHALE	Shale grey, sandstone brown		23'6"				Moderately broken throughout				
SANDSTONE moderately weathered	Brown, moderately soft and weak rock. Bedding at 25°		26'0"								
	Pink sandstone		32'0" 33'8"								
			34'8"				Very broken zone				
	Shale fragments Rounded S.S. cobbles		37'0" 38'0" 39'10"					Hole reported dry by driller			
			43'4"								
			45'10"				3" pink clay seam				
	Pink sandstone		47'9"								
	Bedding at 25°		51'10"								
	Moderately hard rock.		52'10				Clay seam				
			55'9"								
	Very soft rock		58'1" 59'8"				Very broken with clay				
	Bedding at 30°		65'10"								
SHALE	Grey, soft rock		67'6"				Broken zone & clay				
SANDSTONE & SHALE interbedded	Soft, broken material with much core loss		75'6"				Very broken with much core loss				
	END OF HOLE		79'6"								

DRILL TYPE E1000 Mindrill

FEED

CORE BARREL TYPE Triple tube split inner tube

DRILLER A. Harris

COMMENCED

COMPLETED 9/7/68

LOGGED BY R. Craven

VERTICAL SCALE 10 feet: 1 inch

NOTES

FRACTURE LOG :- Number of fractures per foot of core. Zones of core loss are blacked in.

BEDDING AND JOINT PLANES :- Angles are measured relative to a plane normal to the core axis

WATER PRESSURE TESTS

PACKER TYPE

SUPPLY LINE

VERTICAL SCALE

Figures given are gauge pressures
Test sections are indicated graphically by blacked-in strips

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE

COLOUR

To accompany Record 1969/41

I55/A16/564

M(Pf)99

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT CAMP HILL SITE INVESTIGATION

LOCATION CAMP HILL - Near eastern edge of West Block car park

ANGLE FROM HORIZONTAL 90° DIRECTION

COORDINATES 4900N, 35000E Approx. R.L. 1880' Approx

HOLE NO. Hole drilled for A.N.U. Geochronology

SHEET 1 OF 3

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	GRAPHIC LOG	DEPTH & SIZE OF CORE	FRACTURE LOG	LIFT & % CORE RECOVERY	CASING	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL	WATER PRESSURE TEST Loss in gallons per minute per foot	CORE BOX No.	CORE SAMPLE No.
Soil and clay			3'6"								
SHALE mod. weath.	Shale fragments & clay		6'2"								
SHALE moderately weathered	Light brown, moderately soft and weak rock. Max. core length 8", mode 4". Rock broken in many places, probably due to drilling. However short core lengths even in unbroken zones indicate close jointing. Iron staining of many joints and bedding planes.		10'				Bedding Dip 20° Rock laminated in places throughout.				
			20'				Bedding Dip 15°				
			30'				Bedding Dip 25°				
			40'				Bedding Dip 30°				
			50'				Bedding Dip 25°				
			60'				Bedding Dip 25°				
			70'				Bedding Dip 35°				

DRILL TYPE

FEED

CORE BARREL TYPE

DRILLER C. Nilon

COMMENCED 1964

COMPLETED

LOGGED BY G.A.M. Henderson

VERTICAL SCALE 10 feet: 1 inch

NOTES

FRACTURE LOG :- Number of fractures per foot of core. Zones of core loss are blacked in.

BEDDING AND JOINT PLANES :- Angles are measured relative to a plane normal to the core axis

Core lifts were not recorded, consequently percentage core recovery could not be calculated

WATER PRESSURE TESTS

PACKER TYPE

SUPPLY LINE

VERTICAL SCALE

Figures given are gauge pressures
Test sections are indicated graphically by blacked-in strips

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE

COLOUR

To accompany Record 1969/41

I 55/A16/563 (1)

M(Pf) 99

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT CAMP HILL SITE INVESTIGATION

LOCATION CAMP HILL - Near eastern edge of West Block car park

ANGLE FROM HORIZONTAL 90° DIRECTION

COORDINATES 4900N, 35000E Approx. R.L. 1880' Approx.

HOLE NO. Hole drilled for A.N.U. Geochronology

SHEET 2 OF 3

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC	GRAPHIC LOG	DEPTH & SIZE OF CORE	FRACTURE LOG	LIFT & % CORE RECOVERY	CASING	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL	WATER PRESSURE TEST Loss in gallons per minute per foot
SHALE Slightly to moderately weathered	Light brown to blue-grey moderately soft and weak rock.		90'6"				Dip 40° Rock laminated in places throughout. Bedding Dip 35°		
SHALE Slightly weathered	Blue-grey, moderately soft and weak rock.		98'3"						
SHALE Mostly fresh, slightly weathered in some broken zones.	Blue-grey, moderately soft and weak rock. Much of core broken, probably partly due to drilling.		100' 110' 120' 125'0"				Bedding Dip 35° Bedding Dip 40° Bedding Dip 35°		
SHALE fresh	Blue-grey, moderately soft and weak rock. Max. core length 6". Most core lengths < 4" Much very broken core; breakage probably due in part to drilling.		130' 140' 150'				Bedding Dip 30° Bedding Dip 50° Bedding Dip 45°		

DRILL TYPE

FEED

CORE BARREL TYPE

DRILLER C. Nilon

COMMENCED 1964

COMPLETED

LOGGED BY G.A.M. Henderson

VERTICAL SCALE 10 feet : 1 inch

NOTES

FRACTURE LOG :- Number of fractures per foot of core. Zones of core loss are blocked in.

BEDDING AND JOINT PLANES :- Angles are measured relative to a plane normal to the core axis

Core lifts not recorded, consequently percentage core recovery could not be calculated

WATER PRESSURE TESTS

PACKER TYPE

SUPPLY LINE

VERTICAL SCALE

Figures given are gauge pressures
Test sections are indicated graphically by blocked-in strips

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE

COLOUR

To accompany Record 1969/41

I55/A16/563(2)

M(Pt)99

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

GEOLOGICAL LOG OF DRILL HOLE

PROJECT CAMP HILL SITE INVESTIGATION

LOCATION CAMP HILL - Near eastern edge of West Block car park

ANGLE FROM HORIZONTAL 90° DIRECTION

COORDINATES 4900N, 35000E Approx. R.L. 1880' Approx.

HOLE NO. Hole drilled for A.N.U. Geochronology

SHEET 3 OF 3

ROCK TYPE & DEGREE OF WEATHERING	DESCRIPTION LITHOLOGY, COLOUR, STRENGTH, HARDNESS, ETC.	GRAPHIC LOG	DEPTH & SIZE OF CORE	FRACTURE LOG	LIFT & % CORE RECOVERY	STRUCTURES JOINTS, VEINS, SEAMS, FAULTS, CRUSHED ZONES	WATER LEVEL	WATER PRESSURE TEST Loss in gallons per minute per foot
SHALE fresh	Blue-grey moderately soft and weak rock. Core lengths rarely > 6", mostly < 4". Much of breakage of core probably due to drilling.		170' 180' 190' 200' 211'0"			Rock laminated in places throughout. Bedding Dip 40° Bedding Dip 45° Bedding Dip 40° Bedding Dip 40°		
	END OF HOLE					211' 0"		

DRILL TYPE

FEED

CORE BARREL TYPE

DRILLER C. Nilon

COMMENCED 1964

COMPLETED

LOGGED BY G.A.M. Henderson

VERTICAL SCALE 10 feet: 1 inch

NOTES

FRACTURE LOG :- Number of fractures per foot of core. Zones of core loss are blocked in.

BEDDING AND JOINT PLANES :- Angles are measured relative to a plane normal to the core axis

Core lifts not recorded, consequently percentage core recovery could not be calculated

WATER PRESSURE TESTS

PACKER TYPE

SUPPLY LINE

VERTICAL SCALE

Figures given are gauge pressures
Test sections are indicated graphically by blocked-in strips

PHOTOGRAPH REFERENCE SYSTEM

BLACK AND WHITE

COLOUR

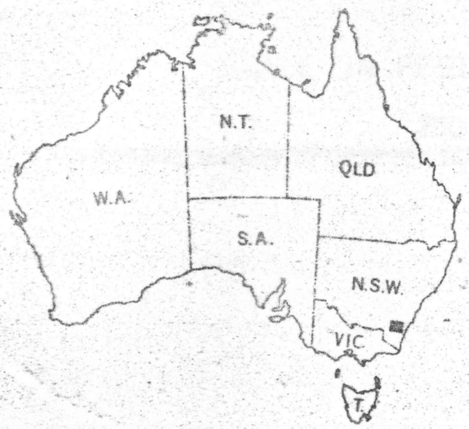
To accompany Record 1969/41

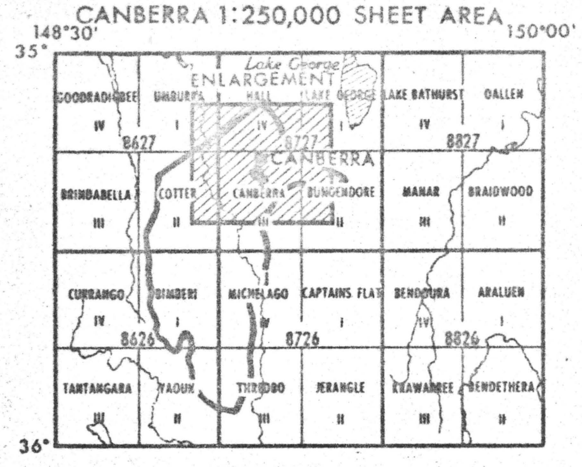
I55/A16/563(3)

M(Pf)99

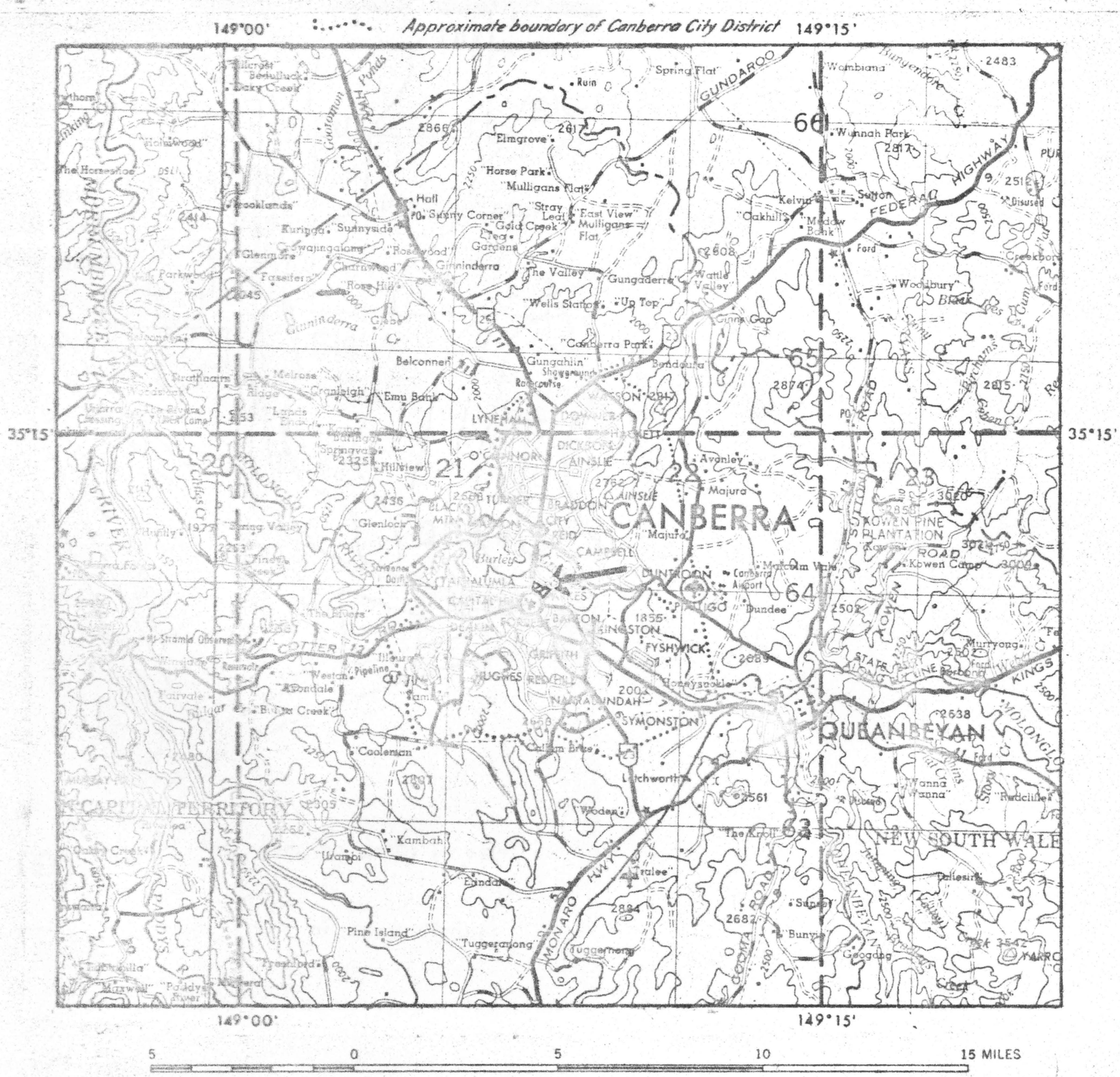
Fig. 1

CAMP HILL LOCALITY MAP





Locality indicated by arrow



Bureau of Mineral Resources, Geology and Geophysics
To accompany Record 1969/41

I55/A16/560

PLATE 1

GEOLOGY OF THE CAMP HILL AREA

SCALE IN FEET

200 0 200 400

Parliament House

True North
Magnetic North

QUEEN VICTORIA TERRACE

DD1 70'

DD2 100'

DD3 60'

DD4 70'

A.N.U. DIAMOND DRILL HOLE (APPROX. LOCATION)

PARKING AREA

TRAVERSE A

TRAVERSE B

D.D.C 80'

SOIL DUMP

Govt. Offices West Block

Govt. Offices East Block

COMMONWEALTH AVENUE

KINGS AVENUE

STATE CIRCLE

REFERENCE

DD.1 70' — Drill hole showing depth in feet

—·— Surface trace of sewer tunnel

——— Seismic traverse

Sls — Shale

Slc — Sandstone and Siltstone

10 — Dip and Strike of Bedding

Shear Zone

--- Geological Boundary, Position Approximate

— — Fault, Position Approximate

Note: The rock shown along the south side of Queen Victoria Terrace was exposed only in a sewer tunnel and does not crop out at the surface.

Bureau of Mineral Resources, Geology and Geophysics, June 1968

I55/A16/561

To accompany Record 1969/41

PLATE 2

CROSS SECTIONS OF CAMP HILL AREA

For locations of traverse lines see Plate 1

SCALE

Feet 50 0 50 100 150 200 Feet

D.D.1 Drill Hole Number

Overburden

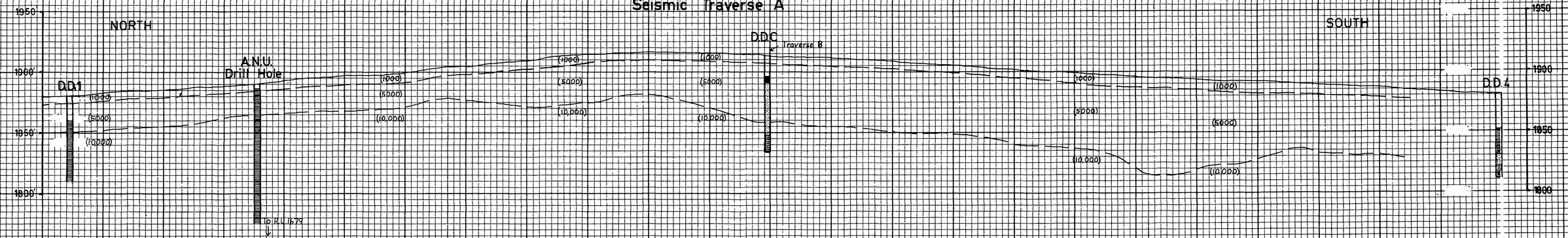
Shale

Silty Shale

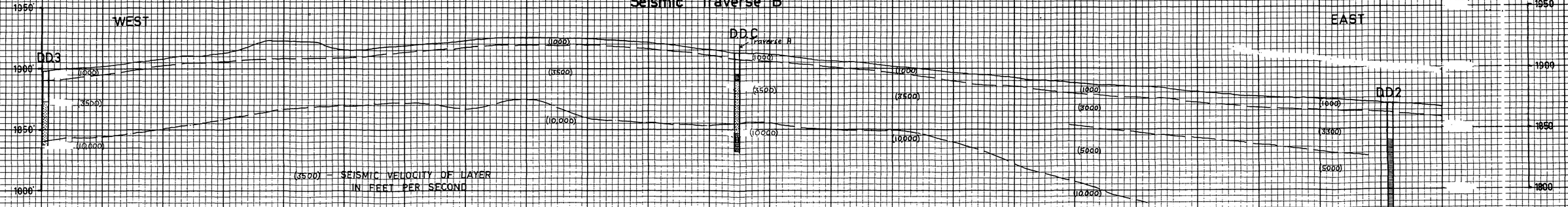
Interbedded Sandstone & Shale

Sandstone

Seismic Traverse A



Seismic Traverse B



(3500) – SEISMIC VELOCITY OF LAYER IN FEET PER SECOND