1952/10

COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS

RECORDS:

1952 / 10

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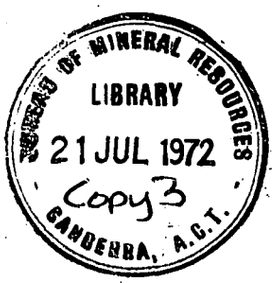
A GEOLOGICAL RECONNAISSANCE OF THE SOUTHERN PORTION OF THE A.C.T.



by

G.E.McINNES & J.B.JONES (students)

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COMMONWEALTH OF AUSTRALIA.

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~~REPORT NO.~~

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Map in C.G.'s copy.

A GEOLOGICAL RECONNAISSANCE OF THE SOUTHERN PORTION OF THE A.C.T.

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G.E. McInnes and J.B. Jones, Students

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INTRODUCTION

The work done in this investigation was for use in the compilation of a large scale geological map of the A.C.T. The area mapped adjoins that mapped by Flinter and McInnes (1949) and L.C. Noakes (1946). The map accompanying this report includes all of the A.C.T. south of an east-west line through Tharwa.

Methods.

Access to the area was by the Tharwa-Gudgenby-Cooma Road and the Yaouk-Cotter Homestead bridle track. It was found possible to take a jeep along this bridle track as far north as the Cotter Homestead, although this trip should not be attempted after rain.

The field mapping was done with the aid of aerial photographs, the data collected being transferred to maps prepared by National Mapping from uncorrected photo mosaics at approx. 2" = 1 mile. In places, due to shortage of time and difficulty of access, geological boundaries were extended by photo interpretation, and such boundaries are shown as approximate on Plate 1.

Physiography

The area may be divided into two smaller areas

(a) The Cotter River drainage area
(b) The Gudgenby River drainage area

The Cotter River valley exhibits rather unusual physiographic features. In the headwater tract the valley is quite mature with a wide flat floor, formerly used for grazing, whereas downstream its confluence with Kangaroo Creek, the valley is steep sided and youthful. This change in topography is probably to be explained by uplift in Tertiary time although there is a change in lithology from soft slates upstream to hard quartzites downstream.

The course upstream of Kangaroo Creek has been determined largely by the regional strike of the phyllites.

The valleys of some of the tributaries of the upper Cotter River are straight and u-shaped suggestive of a glacial profile. As these valleys are topographically below the country affected by Pleistocene glaciation in this area, an explanation of these features is difficult, unless they are remnants of the Permian glaciated surface. This possibility is suggested by the occurrence of fluvo-glacial deposits at Canberra which Dr. Opik believes may be Permian in age.

The Gudgenby and tributaries exhibit many of the features already noted in connection with the Cotter River. However there is one notable difference in that most of the tributaries flowing in from the west are obsequent. This was explained by Professor Griffith-Taylor as being due to reversal of the flow direction of the Gudgenby, through tilting, making this stream, previously a tributary of the Snowy River, flow into the Murrumbidgee. The gorge in the Gudgenby River near its confluence with the Murrumbidgee regarded by Griffith-Taylor as cutting through the old divide, is probably due to a fault running N-S just to the east of the Naas River. This fault, up-thrown to the east, has cut off the old river course forcing it to cut a channel for itself through the uplifted block. This is supported by

the existence of some fresh water deposits on ridges above the present stream, indicating damming, and the presence of gravels on the peninsula between the Murrumbidgee and present Gudgenby Rivers.

The Orroral River valley has many of the features of those tributaries of the Cotter previously mentioned, together with what appear to be hanging valleys. If, as Dr. Opik suggests, a Permian surface remains in Canberra, there is no reason why such glacial features should not be found in the adjacent mountains, especially as active erosion only became possibly after the Kosciusko uplift. On the other hand rounded features are characteristic of granite areas and when aided by a fracture pattern such as exists here, valleys of the form noted could be formed. Therefore the question of the glacial origin of these valleys is one which must be left open until more detailed work can be done by workers more experienced in glacial topography.

Stratigraphy.

The sedimentary rocks of the area are of two ages, Ordovician and Silurian.

The Ordovician rocks which occur in the Cotter Valley have been assigned to two formations by L.C. Noakes and B.P. Walpole on account of differences in the degree of metamorphism. The formations are separated by a strike fault known as the Cotter fault in the area mapped by L.C. Noakes and B. Walpole. The existence of the fault cannot be proven in the area examined by us, but rocks of both Kangaroo Creek and Franklin Formations have been identified in the vicinity of the Cotter Homestead.

The Kangaroo Creek Formation consists largely of phyllites and brown micaceous sandstones with some greywackes. The micaceous sandstone appears to be characteristic of the Kangaroo Creek Formation and is readily identifiable at many places. The beds dip steeply to the west; the dip is always more than 60° and often over 85°. It seems fairly certain that the Kangaroo Creek Formation is Upper Ordovician although no fossils have yet been found in the type area. Further fieldwork may indicate that Kangaroo Creek formation is part of the Franklin Formation as suggested by Noakes (1946) but at present it is wise to retain the two formation names. The grade of regional metamorphism rises towards the west until, when cut off by granite on the flanks of Mt. Bimberi, the top of the biotite zone has been reached. This granite is later than the regional metamorphism, we think, and probably of similar age to the Tharwa granite. A little further to the west however, at Mt. Murray, a probable Ordovician granite occurs. The Mt. Murray granite is probably related to the regional metamorphism, but it is now interposed between the later, epi-Silurian intrusive granite near Mt. Murray and the Ordovician sediments along the Cotter Valley.

The abrupt change fromrocks of the Franklin Formation to the less metamorphosed Kangaroo Creek Formation at the Cotter River near the homestead suggests the existence of a fault. None was found in the field (see structural section).

Unconformably overlying the Kangaroo Creek formation in the area adjacent to Kangaroo Creek is the Tidbinbilla Quartzite of probable Lower Silurian age. The beds dip 8-10° to the N.E. In the area mapped by us the quartzite occurs only as isolated outliers but to the north a large mass is faulted against the Franklin formation. The Tidbinbilla quartzite is an extremely hard grey rock and appears to be a strongly silicified sandstone. The reason for this silicification is difficult to find, as any metamorphism due to the intrusion of the Tharwa granite would have been expected to affect the Kangaroo Creek Formation to at least the same extent. That this has not occurred must be attributed to one of the following reasons:

(a) The Tidbinbilla and Kangaroo Creek formations were not associated at the time of silicification, or
(b) The Kangaroo Creek Formation, which was folded before the intrusion of the granite, was not so susceptible to silicification possibly because the beds were less pervious to silica-bearing solutions.

As no evidence of faulting between the Kangaroo Creek and Tidbinbilla Formations was seen, (a) can be eliminated.

In the Gudgenby River area there is a pendant of sediment extending from the Orroral River junction, south to the border of the A.C.T. ☆ No fossils were found in these sediments but on lithological similarity they are correlated tentatively with the Kangaroo Creek Formation. At the northern extremity, the belt is only a few yards wide but it rapidly widens until it is approximately two miles wide. The boundaries remain roughly parallel as far south as they were mapped. The sediments seem to be only a thin veneer over the granite as tongues of granite may be seen extending into the sediment on the sides of hills flanking the Gudgenby-Boboyan Road. As well as the typical micaceous sandstone there occurs a considerable thickness of phyllite and black slate which should be graptolite bearing. No graptolites were found but our search was not exhaustive. Dr. Opik found a small group of pyrites crystals in a quartzite near the Gudgenby River, which he believes to have been a graptolite, probably Ordovician in age.

A feature found in the western edge of this mass, not noted elsewhere in the Kangaroo Creek Formation, was the intense silicification of some bands of sandstones against the Tharwa granite. It may have been that the particular beds were suitably situated as regards the granite to receive solutions or that the narrowness of the sedimentary belt at this point was responsible for the concentration of solutions within it.

Igneous Rocks

The main igneous mass of the area is the Tharwa granite or Murrumbidgee Batholith. The rock is essentially a biotite granite with associated pegmatitic and aplitic veins. In places there is some hornblende, sufficient to warrant altering the name to quartz mica diorite. From an examination of the quarry at Tharwa it appears that there are two intrusions, separated in time by the intrusion of an acid vein type. The first intrusion was a coarse grained biotite granite, the second a very acid type with little or no ferromagnesian mineral and the third a finer grained biotite granite. A hybrid has been formed between the first and third intrusions. The hybrid has a characteristic patchy distribution of biotite which is quite obvious even on weathered surfaces. The nature of the contacts between the biotite granites suggests that the first was not completely consolidated before the finer grained type was injected. The relationship of the white acid type to the other intrusives is not definite because no contact with the finer grained type was found.

A feature of the mass is the degree of orientation on the eastern margin which becomes less and less, although never completely disappearing until in the west it begins to intensify again. This orientation is almost certainly primary and related to the mode of emplacement. Fracture and orientation directions measured at various places in the mass are shown on Plate I. It should be noted that the coarser grained type predominates in the west and the finer grained in the east.

☆ A graptolite of upper Ordovician age was found during Dec. 1951 on a subsequent visit to the area.

The western, Gingera granite does not differ markedly from the Tharwa granite except that in general it is finer grained. It is similar to the third type as described at Tharwa. The joint directions and orientation are similar to those of the Tharwa mass suggesting that they were probably contemporaneous.

At Mt. Murray, within the Gingera granite there occurs what appears to be an unrelated mass of granite rich in clots of red brown biotite. A specimen of this granite was compared with known Ordovician granites from Wagga and Tumut Ponds and, in the opinion of T.G. Vallance, is possibly of Ordovician age also. No attempt was made to delineate this type in the field as all contacts with the later granite are indefinite and the time consumed in mapping would be too great.

In the Cotter Valley there occurs yet another granite, about 1 mile north of the Homestead, similar lithologically to the Tharwa type. This small outcrop is significant structurally because it occurs only on the western side of the Cotter River and so suggests a fault along the river.

At various places in the Cotter Valley small areas of dark "Cotter" porphyry occur. These occurrences are as small dykes, but with one exception they are too small to show on our map. It is not possible to determine their age in this area because they intrude only the Kangaroo Creek Formation.

Structural Geology

The dominant structural features are the general north-south parallelism of boundaries and faults, and the prominent north-westerly fracture direction in the granites. The meridional trend is common in eastern N.S.W. and is represented in this area by the Cotter fault, the strike of the Ordovician sediments and the orientation of crystals in the granite.

The Cotter fault has been mapped as far south as Kangaroo Creek by L. C. Noakes (1940). It was thought from a preliminary examination of the area that the fault dies out at Kangaroo Creek but a subsequent examination of maps and air photos suggests that it may continue south at least to the southern border of the A.C.T. The abrupt junction between Franklin and Kangaroo Creek Formations, the occurrence of Tharwa-type granite in the Cotter Valley and the straight-line boundary of the Tharwa mass south of the Cotter Homestead all point to the possibility of the fault continuing south (see appended geological section).

Another fault was found striking across the Cotter River about 2 miles north of the homestead. As well as being prominent on the air photos, a considerable number of slickenslided rock fragments was found in the field. Further evidence of fracturing is that a creek flowing down the postulated fault line is at most times dry whereas there is always a flow at the point where the Creek joins the Cotter River. The fault has been called Smiths Creek Fault after the owner of a hut on the Cotter near the mouth of this creek. The fault is terminated at each end by granite so it is probable that it is pre-granite in age. The length is approximately 2 miles.

A short east-west fault with little displacement was seen near the section of Clear Hills Creek with the Cotter River. It has displaced two dykes of porphyry and hence is of post porphyry age.

The fault previously mentioned in the physiographic history of the Gudgenby River is probably Tertiary in age as a scarp can still be seen to the east of the Naas River. The throw may reach a maximum of 400 feet, with down throw to the west.

ACKNOWLEDGMENTS.

We wish to acknowledge the help of Dr. G.A. Joplin and Mr. L.C. Noakes in the identification and description of specimens and in discussion of problems raised during the field work. To

Mr. Jack Maxwell, the Forest Ranger, our thanks are also due, for help and co-operation in the field.

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APPENDIX I

DESCRIPTION OF ROCK SLIDES.

Slide No. R2048

Locality: Eastern flank of Mt. Murray.

Appearance: Fine grained, finely banded grey rock. The bands are alternately light and dark giving the rock its grey colour.

Mineral Content: Quartz, Biotite, Muscovite, Tourmaline, Felspar.

Quartz forms 70 per cent of the rock. The crystals are cracked and show shadow extinction indicating strain.

Biotite - occurs in small flakes throughout the rock. The flakes are pleochroic from light brown to dark brown being apparently one of the lower temperature forms.

Muscovite - not as plentiful as the biotite but forms about 10 per cent of the rock. The flakes are twisted and distorted due to strain.

Tourmaline - and felspar - occur as small crystals but in small numbers.

Name: Metamorphosed Greywacke

Slide No. R2049

Locality: Eastern flank of Mt. Murray.

Appearance: A fine grained grey rock of phyllitic texture.

Mineral Content: Quartz, Biotite, Sericite.

Quartz - also forms about 70 per cent of this rock. The crystals are all severely shattered and again show shadow extinction.

Biotite - occurs in very small cleavage flakes. The flakes are pleochroic from colourless to pale brown.

Sericite - occurs plentifully but in minute flakes.

Name: Sheared micaceous siltstone.

Slide No. R2050

Locality: Eastern flank of Mt. Murray

Appearance: Dark, holocrystalline rock with entirely kaolinised crystals of felspar.

Texture: Porphyritic.

Mineral Content: Quartz, Microcline, Albite, Biotite.

Quartz - forms about 40 per cent of this rock. It again is shattered and shows shadow extinction.

Felspar - seems to be mainly microcline but an acid plagioclase, probably albite or albite-oligoclase is present. Much of the felspar is mottled due to minute inclusions. The felspars form about 50% of the rock.

Biotite - occurs as large flakes, twisted and contorted, often around quartz crystals. The crystals are pleochroic from light brown to dark brown.

Name: Sheared porphyry.

Slide No. B2051.

Locality: Eastern flank of Mt. Murray.

Appearance: A fine grained light coloured rock.

Texture: Schistose

Mineral Content: Quartz, plagioclase, Biotite, Muscovite, Apatite.

Quartz - forms 60 per cent of the rock. It shows shadow extinction and is elongated in the direction of schistosity.

Plagioclase - forms 20 per cent of the rock. It appears to be albite or albite-oligoclase.

Biotite - forms about 20 per cent of the rock. It is contorted and stretched in the direction of schistosity.

Name : Sheared arkose.

Slide No. B2052.

Locality: Eastern flank of Mt. Murray

Appearance: A fine grained light coloured rock. The rock has a soapy feel.

Texture: Schistose

Mineral Content: Talc, sericite. The whole rock is extremely fine grained and the minerals are very difficult to identify with any certainty. It appears to be mass of pure talc and sericite.

Name: Talc schist.

Slide No. B2055

Locality: Eastern flank of Mt. Murray.

Appearance: Fine grained shining black rock. The contact with a pegmatite vein is shown.

Mineral Content: Hypersthene, Diopside, Quartz, Plagioclase, Sphene.

The quartz shows shadow extinction and shatterings.

Name: Granulite

Slide No. B2054

Locality : Eastern flank of Mt. Murray.

Appearance: Light holocrystalline rock with numerous crystals of biotite.

Texture: Granitic

Mineral Content: Quartz, Plagioclase, Biotite.

Quartz - forms about 60 per cent of the rock. It is shattered and shows shadow extinction.

Plagioclase - appears to be oligoclase andesine. Some crystals show evidence of strain.

Biotite - shows little or no sign of strain. It is a reddish brown colour suggesting one of the higher temperature varieties. There are numerous inclusions with dark steel grey pleochroic haloes.

Name: Oligoclase Granite.

Slide No. B2055

Locality: Mt. Murray.

Appearance: A dark, coarse grained holocrystalline rock.

Texture: Granitic

Mineral Content: Quartz, Microcline, Orthoclase, Plagioclase, Biotite, Muscovite.

Quartz - forms 60 per cent of the rock and felspars 25 per cent. The quartz shows shadow extinction.

Plagioclase appears to be oligoclase

Biotite is a deep red-brown colour indicating a high temperature. There are numerous inclusions giving pleochroic haloes.

Name: Hybrid biotite granite.

Slide No. B2056.

Locality: Mt. Murray.

Appearance: Dark fine-grained rock with a few phenocrysts of plagioclase.

Texture: Porphyritic

Mineral Content: Basic plagioclase, augite, magnetite, quartz.

Name: Intrusive basalt.

Slide No. B2057

Locality: Eastern flank of Mt. Bimberi

Appearance: Very fine grained, dark green rock with a coarse band of quartz through it.

Texture: Schistose

Mineral Content: Quartz, Sericite, Biotite, Chlorite.

Quartz appears to have been a sandy band in an otherwise fine grained mud. It shows shadow extinction.

Biotite. Some of the biotite appears to have been developed by dynamic metamorphism since it is a yellow-brown type. This would place the grade of metamorphism in the lower part of the biotite zone.

Name: Chlorite sericite schist.

Slide No. B2058

Locality: Eastern flank of Mt. Bimberi

Appearance: Fine grained and micaceous

Texture: Schistose

Mineral Content: Sericite, quartz.

Quartz shows shadow extinction.

Name: Quartz, sericite schist.

Slide No. B2059

Locality: Eastern flank of Mt. Bimberi

Appearance: Fine grained, light coloured

Texture: Schistose

Mineral Content: Quartz, Microcline, Sericite, Biotite, Chlorite, Magnetite, Plagioclase

Quartz shows shadow extinction

Name: Sheared greywacke

Slide No. R2062

Locality: Nursery Hill

Appearance: Fine grained grey rock with a small vein of aplite through it.

Mineral Content: Sericite, quartz, Chlorite, Biotite. The biotite is strongly pleochroic from reddish brown to deep brown. Small amounts of hematite and rutile are present. It appears that the rock has undergone regional metamorphism with the production of chlorite and then contact metamorphism with the production of biotite.

Name: Metamorphosed Greywacke.

Slide No. R2063

Locality: Nursery Hill

Appearance: Medium-even-grained rock, dark in colour.

Mineral Content: Sericite, Biotite, Quartz, Muscovite.

Biotite is pleochroic from pale yellow to deep red brown. It contains numerous dark, steel grey pleochroic haloes round inclusions which are probably zircon. The crystals also contain large muscovite inclusions indicating growth in the solid.

Name: Metamorphosed Greywacke.

Slide No. R2065

Locality: Nursery Hill

Appearance: Dark, coarse grained rock with white phenocrysts.

Texture: Porphyritic

Minerals Present: Quartz, plagioclase, microcline, biotite.

Quartz shows undulose extinction and is fractured and in places actually crushed. The texture is mylonitic in parts of the slide.

Plagioclase appears to be an acid labradorite.

Name: Sheared quartz porphyrite

Slide No. R2066

Locality: Nursery Hill

Appearance: Light brown and green rock of very fine grain.

Minerals Present: Quartz, Epidote, Augite.

Name: Granulite

Slide No. R2067

Locality: Mt. Tennant

Appearance: Light coloured, medium grained rock

Minerals Present: Quartz, Felspar, and brown biotite.
The rock is characterised by well developed flow structure and numerous spherulites.

Name: Rhyolite

Slide No. R8082

Locality: Nursery Hill

Appearance: Light coloured fine grained rock.

Minerals Present: Quartz, Microcline, Orthoclase, Oligoclase, Chlorite.

The quartz shows signs of strain.

The oligoclase and orthoclase occur in microperthitic intergrowth.

Name: Aplite

Appendix II Not to be typed.

Dips and Strike in Ordovician Sediments

Kanganoo Ck Formation

Locality	Dip	Strike
Cotter H.S. crossing	80° W	335°
1 mile North H.S.	70° W	4°
2 mile North H.S.	90°	340°
1½ mile up de Salis Ck.	90°	5°
1¼ miles up de Salis Ck	80° W	355°
Junction de Salis Ck + Cotter R.	80° W	345°
Cotter R near de Salis junction	90°	350°
Clear Hill Ck	80° W	340°
Gudgenby R near H.S.	80° W	34.°
Top of Nursery Hill at track	70° E	350°
Sediment in nearby ck	60° E	345°
Murrarat R	90°	320°
Cotter R near Licking Hole Ck	90°	345°
Licking Hole Ck near granite contact	70° W	340°
? Franklin Formation		
Bimberi ck near dray track.	90°	345°
Murray Gap track (Kelly 110°)	80° W	340°

Silurian Sediments

Tidbinbilla Formation.

Clear Hill Ck	20° NE	120°
Cotter R ½ mile south.	20° NE	125°

Joints and Orientations in Thanna Granite.

Locality.	Strike	Dip	Remarks.
Amaral Trig	310°	90°	qtz veins
	355°	85°W	lineation
Coronet Ridge Cotter Valley.	325°	90°	
	250°	90°	
Coronet Trig	10°	80°E	
	245°	85°S	
	305°	85°S	Qtz veins.
	325°	90°	lineation
Kelly Trig	85	90°	
	345°	90°	
	335°	80°W	lineation
Gidgenby R. near H.S.	180°	10°E	
	315	90°	
	280°	90°	
	345°	80° W	lineation
Nursery Hill	255°	90°	
	25°	90°	
	310°		lineation
On road 2 miles North of Glendale ~~Holy~~ Crossing.	245°	90°	
	320°	90°	
	360°		lineation
Naas Rd Junction	340°		
	350°		
	330°		lineation

Locality	Strike	Dip	Remarks
Thanwa Bridge	245°	85° W	
	228°	90°	
	325°		lineation
	280°	90°	Pegmatites.
	205°	90°	
Boorooma Rd (Tennent bearing 160°)	85°	Steep.	
	165°	"	qtz veins.
	325°	"	
Boorooma Rd (Paddy's R crossing)	180°		
	280°		
	40°		Pegmatites
	320°		lineation.
Boorooma H.S.	325°		
	185°		
	305°		minor
	205°		
	325°		lineation
Boorooma Rd 3/8 mile west of Castle Hill	145°		
	180°		
	165°		lineation.
Tridbinbilla Rd (Paddy's R)	110°		
	40°		
	70°		
	5°		lineation.

Gingera Granite.

Locality	Strike	Dip	Remarks.
1 mile east of Bimberi	330°	80° W	
	70°	90°	
	1200	25° N	
Bimberi trig.	340°	90°	
	315°		
	340°		Kinnaskai.

Mt Murray Granite.

Locality.		
Murray trig.	Close jointing vertical striking 355°	

STROMLO
BRICK
RED HILL
C
D
MOLONGLO RIVER
MANON
RAILWAY
GUEANBEYAN
QUARTZ
JERRABOMBERRA
TAYLOR
NEIGHBOUR
FORSTER
WANIASSA
KAMBAH POOL
A
PEMBERTON
E
F
PADDY'S RIVER
CASTLE HILL
Woolshed Creek
VILLAGE OF THARWA
Bridge
Tharwa
Sawyers Gully
Bridge
Blue Gum Creek
Rob Roy
Campbell
Royalla
Gigerline
MURRUMBIDGEE RIVER
Smiths Road
Guises Creek
Lobby
Warri
Tennent
GUDGENBY RIVER
Lobbs Hole Creek
Williamsdale Station
Burra Creek
Burra Road
Georges Creek
Honeysuckle Creek
Angle Crossing Road
TERRITORIAL BOUNDARY
Angle Bend Ford
Deep Creek
Cunningham Hill
Hole Creek
Water
Boorcoomba Creek
NAAS HOMESTEAD
Ford
RIVER
NAAS RIVER
Mount Creek
GUDGENBY

GEOLOGICAL SKETCH MAP
OF THE
CANBERRA - THARWA AREA

SCALE
MILES 1 ¾ ½ ¼ 0 1 MILES

REFERENCE

- Granite
- Porphry
- Aluvium
- Silurian
- Ordovician

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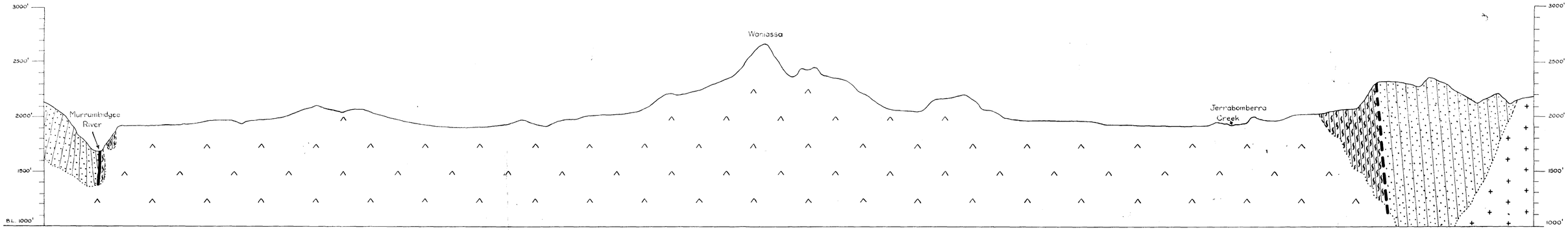

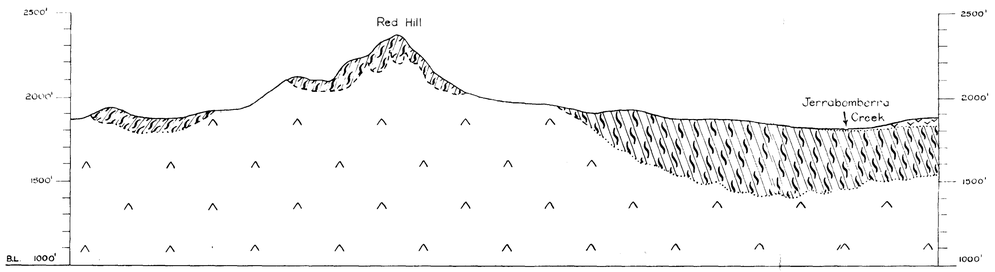

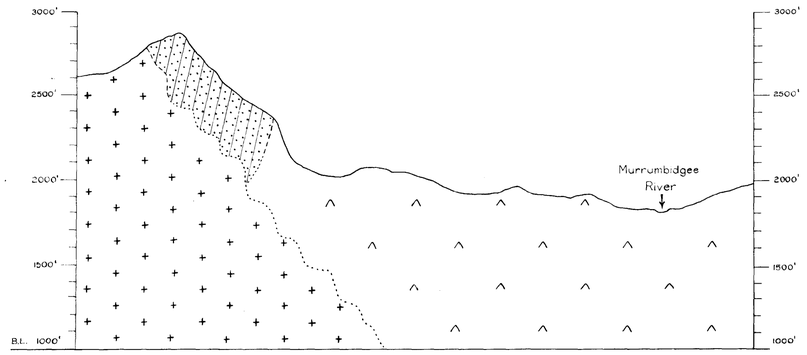

Horizontal Scale

MILES 1 ¾ ½ ¼ 0 1 2 MILES

Vertical Scale

FEET 500 0 500 1000 1500 2000 FEET

GEOLOGICAL SECTIONS

OF THE

CANBERRA - THARWA AREA A.C.T.

REFERENCE

- Granite
- Porphry
- Ordovician Sediments
- Silurian Sediments
- Alluvium

Bureau of Mineral Resources,
Geology and Geophysics, March, 1949.

155/A16/ ACT 02-9
A.J.S.