COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF NATIONAL DEVELOPMENT.

BUREAU OF MINERAL RESOURCES GEOLOGY AND GEOPHYSICS.

RECORDS:

1964/43

THE REGIONAL GEOLOGY OF THE NORTHERN HALF OF THE ALCOOTA 1:250,000 SHEET AREA. N.T.

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by

E.N. Milligan

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THE REGIONAL GEOLOGY OF THE NORTHERN HALF OF THE ALCOOTA 1:250,000 SHEET AREA.

SUMMARY

During 1961, a field party from the Bureau of Mineral Resources, Geology and Geophysics, mapped the Upper Proterozoic and Palaeozoic sediments on the Alcoota 1:250,000 Sheet area, Northern Territory. This mapping was part of a regional survey of the Georgina Basin and linked the Upper Proterozoic and Palaeozoic geology to that of the adjoining Barrow Creek, Elkedra and Huckitta 1:250,000 Sheet areas.

The Precambrian and Palaeozoic geology is summarised in the table below:

		FORMATION	SYMBOL	LITHOLOGY	THICKNESS	STRUCTURE
DEVONIAN	Upper	Dulcie Sst.	Dud	qtz.sst: pebbly	1500'+	flat;low & steep NE dips
	Mid.					
	Lower					
SILURIAN						
ORDOVICIAN	Upper					
	Mid.					
	Lower	Tomahawk Beds	Ot	glauc.sst; sltst; dolomite	400'+	flat;low & steep NE dips
CAMBRIAN	Upper					
	Mid.					
	Lower	Grant Bluff Formation	Pg	red siltst; red&white qtz.sst.	200'+	steep to medium NE dips
PROTEROZOIC	Upper	Central Mt. Stuart Beds	Pus	red lithic sst arkose	1000'+	mainly low SE dips
	Lower	granite, undifferent/d	Pg			
		Mt.Swan Granite	Pgs			
ARCHAEAN		Arunta Complex	Aa	high grade metamorphics		intensely folded

+ Both Grant Bluff Fm. and Central Mt. Stuart Beds rest on basement.

Overlying these rocks are superficial lacustrine deposits of ?Tertiary age and alluvial and aeolian deposits of Quaternary and Recent age.

Apart from the Central Mount Stuart Beds and some outcrops of the Tomahawk Beds, the sediments generally strike north-west and dip to the north-east, forming the south-western flank of the Dulcie Syncline (fig. 3) or, perhaps in the case of the Grant Bluff Formation, a minor parallel trending syncline.

Numerous successful water bores for watering stock and some for irrigation purposes, have been drilled in the area. The most reliable aquifers are the ?Tertiary limestone and the Quaternary - Recent alluvium. Upper Proterozoic sandstone has provided some suitable waters, but the water may be salty and of insufficient quantity. Granite usually produces good water but in small quantity; metamorphic rocks are likely to produce salty water.

Petroleum prospects are difficult to assess; it is possible that non-outcropping source and reservoir beds are present, but no potential traps can be recognised and the prospects must be rated as low.

INTRODUCTION

During 1961, a field party of the Bureau of Mineral Resources, consisting of K.G. Smith and E.N. Milligan, mapped the Upper Proterozoic and younger sediments of the Alcoota 1:250,000 Sheet area, Northern Territory. These rocks crop out in the north and north-east of the sheet area and in the Hann Range, which lies in the extreme south-west of the sheet. For this reason, the survey was restricted to virtually the northern half of the Sheet area.

The specific objects of the survey were:

a) to map the area at photo scale, and to link the mapping to that already completed on the adjoining Barrow Creek, Elkedra and Huckitta 1:250,000 Sheet areas,

b) to measure sufficient stratigraphic sections to establish the sequence and its variations,

c) to assess the underground water potential and

d) to assess the petroleum potential.

A complete air photograph cover at 1:46,500 scale is available from photographs taken by the Royal Australian Air Force in 1950. In the field, observation points and specimen localities were marked on the photographs, and notes on these points were recorded in field note books. Controlled templates at photo scale were available from the Division of National Mapping; geological data was transferred from the photographs to the templates, which were then reduced to publication scale (1:250,000).

Area:

The Alcoota 1:250,000 Sheet is bounded by the 22nd and 23rd parallels of south latitude and the meridians of 133 degrees 30 minutes and 135 degrees of east longitude and covers an area of about 7,000 square miles.

Fig 1a LOCALITY MAP — Showing locality of ALCOOTA 1:250,000 Sheet

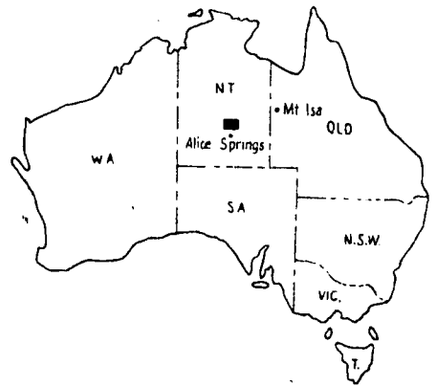
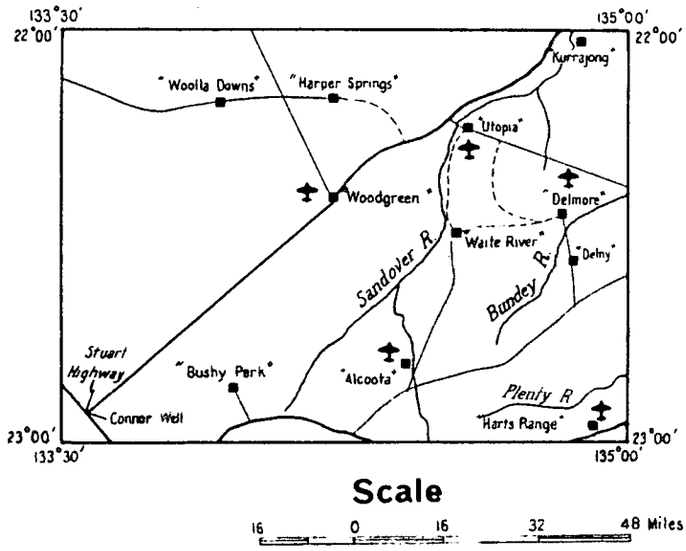


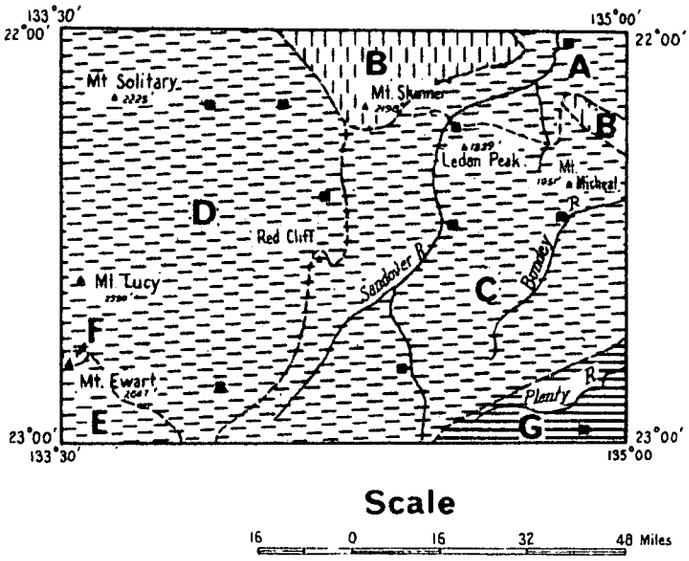
Fig. 1b LOCALITY MAP — Showing Roads and Homesteads



Reference

- Main Road
- Minor Road
- Vehicle track
- Landing ground
- Homestead

Fig. 2 TOPOGRAPHY MAP (Refer Text) Physical Regions after J. A. Mabbutt, 1962



Reference

- A North Eastern Plains.
- B North Eastern Plateaux.
- C Sandover-Bundey Basin.
- D North Western Plains.
- E Burt Plain.
- F North Western Hills and Ranges.
- G Plenty River Plains.
- Homestead

Location and Access:

Figure 1a shows the position of the Alcoota 1:250,000 Sheet area, which is approximately 60 miles north by road from Alice Springs. Figure 1b shows the major roads of the area and the more important vehicle tracks. The bitumenised Stuart Highway from Darwin to Alice Springs passes through the south-west corner of the sheet area. All other roads are formed with an earth surface and may become impassable for several days after heavy rainfall.

Communications:

The area has no Post Office or telephone facilities and there is no scheduled service for surface mail. The station homesteads (see figure 1b) operate transceivers which are linked with the Alice Springs base station of the Royal Flying Doctor Service. This service provides prompt medical attention and transmits and receives telegrams. From its base at Alice Springs, Connellan Airways operates a weekly mail, passenger and freight service to most of the cattle stations in the area.

Alice Springs is the northern terminus of the railway operated by the Commonwealth Railways from Port Augusta; two passenger services per week in summer and one in winter are provided.

Climate:

Long, hot summers and short mild winters are normal. Throughout the winter, the prevailing wind blows strongly from the south-east. The average rainfall is ten inches.

Water Supplies:

The cattle industry is generally dependant on supplies of underground water. Some waterholes retain water for some months after the summer rains.

Physiography and Vegetation:

The major part of the Sheet area is occupied by sand plain, fixed sand hills and by plains of alluvial soil.

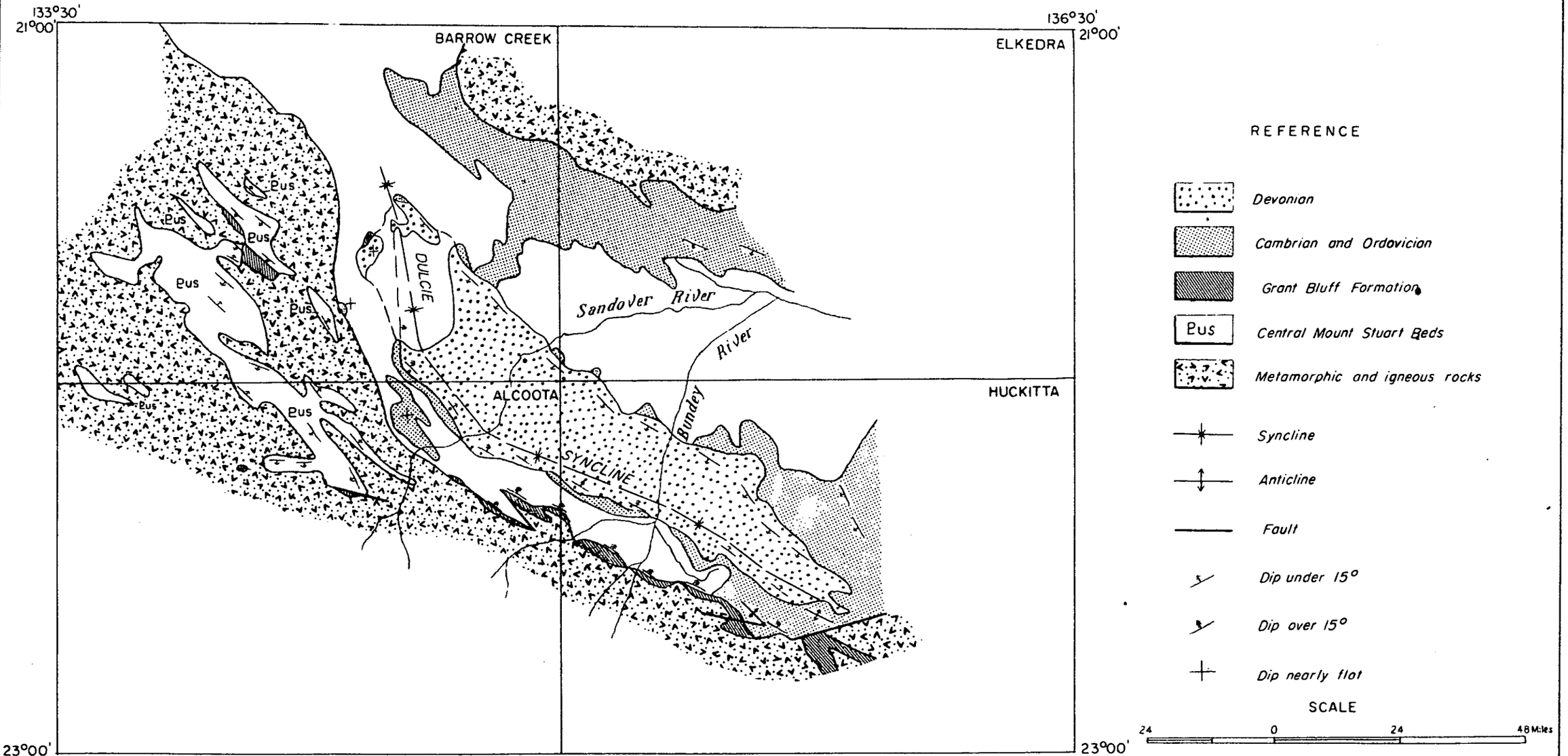
The northern half of the Sheet area comprises parts of certain physical regions described in the Alice Springs region by Mabbutt (1962). These are: (see fig.2).

A. The north-eastern plains, which occupy the north-east corner of the Sheet area and descend from a height of 1,400 feet above sea level toward the extreme north-east. They are predominantly flat to gently undulating sand plains with local areas of low sand hills. Alluvial flood plains with some clay-pans occur near the Sandover River. Vegetation is sparse, comprising low trees, mostly mulga, and widespread spinifex. On the flood plain, ghost gums and coolibah are more common.

B. The north-eastern plateaux, which border the south side of the north-eastern plains. This region comprises low flat topped hills rising to plateaux up to 500 feet above the plains. The vegetation is mainly scattered mulga, witchetty bush and gidgee.

C. The Sandover-Bundy basin, which is an extensive inter-montane basin between the north-eastern plateaux and the Harts and Strangeways Ranges which lie just to the south of the southern margin of the Sheet area. The topography is irregular. Isolated low hills and more extensive hills of aligned ridges are

Fig. 3 — SKETCH MAP OF GEOLOGY OF PART OF ALCOOTA, BARROW CREEK, ELKEDRA and HUCKITTA 1:250,000 SHEETS



Bureau of Mineral Resources, Geology and Geophysics

To accompany Record No. 1964/43

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interspersed with undulating plains and small alluvial fans. Mulga occurs in scattered patches, but over large areas witchetty bush is the predominant species.

D. The north-western plains, which comprise extensive areas of stable alluvial sand plain with very low gradients, and support large stands of mulga. Areas of hummocky sand plain and low sand hills are common in the west. The only significant relief is formed by isolated steep sided hills of archaean rocks which rise up to 200 feet above the plain. Low limestone platforms occur locally in low lying areas.

PREVIOUS INVESTIGATIONS

Hossfeld (1954) regarded the Palaeozoic sediments of the Alcoota 1:250,000 Sheet as Ordovician, due to the similar lithology and stratigraphic position to rocks in the Toko, Tarlton and Dulcie Ranges which contain Ordovician fossils. He considered them to fill an 'Ordovician Gulf' trending roughly north-west between the Precambrian Arunta Block to the south and the 'Ashburton Peninsula' to the north.

Officers of the Bureau of Mineral Resources have previously mapped the adjoining 1:250,000 sheets to the north (Barrow Creek: Smith and Milligan, 1964), and to the north-east (Elkedra: Smith and Milligan 1963) and to the east, (Huckitta: Smith, 1964). They have postulated a north-west continuation of a syncline (Dulcie Syncline) (see figure 3) of Palaeozoic rocks which occurs in the Huckitta Sheet area and has been traced into the Barrow Creek area.

GEOLOGY

Metamorphic rocks of the Arunta Complex of Archaean age are the oldest rocks in the area. They form the Arunta Block which comprises the greater part of the outcrop in the sheet area. These rocks have been intruded by granites which are Lower Proterozoic in age. In the north of the Sheet area, the Upper Proterozoic Central Mount Stuart Beds lie unconformably on the basement rocks. In the north-east sector of the area, the Upper Proterozoic - Lower Cambrian Grant Bluff Formation lies directly on the basement also. The relationship of the Central Mount Stuart Beds to the Grant Bluff Formation is uncertain. The oldest Palaeozoic outcrops are sandstone of the Upper Cambrian-Lower Ordovician Tomahawk Beds, but in the Huckitta Sheet area, Upper Cambrian limestone, siltstone, and sandstone are known, from bore information, to lie under the sandcover in a position topographically below and presumably stratigraphically below the outcropping Tomahawk Beds. Overlying the Tomahawk Beds unconformably is the Devonian Dulcie Sandstone. ?Tertiary cherty limestone occupies the position of some old river valleys.

ARCHAEAN

The rocks were not studied during the survey, but were observed to include high grade metamorphics, quartz-mica schist, quartz-biotite-feldspar schist and quartz-biotite-feldspar-garnet gneiss.

LOWER PROTEROZOIC

Granites are known to intrude the Archaean rocks of the Alcoota Sheet area. Smith (1964) noted that the Mount Swan Granite, which outcrops in the west of the Huckitta Sheet area, extended westward into the Alcoota Sheet area. Hurley *et al.* (1961) have determined the age of the Mount Swan Granite as 1460 ± 40 million years.

UPPER PROTEROZOIC

Central Mount Stuart Beds

The name has been given by Smith and Milligan (1964) to a sequence of dark red dominantly lithic psammites which crop out extensively in the south-western part of the Barrow Creek 1:250,000 Sheet area and at Central Mount Stuart on the Mount Peake Sheet farther to the west. The rock types were predominantly dark red and brown lithic psammites, silty psammites and lutites, but pink, regularly bedded, ripple marked quartz sandstone, conglomerate and thin brown, coarsely crystalline dolomite occur near the base of the sequence.

The Alcoota occurrences are a south-east continuation of a belt of these rocks, which for the most part, have shallow dips to the south west, although dips up to 70 degrees occur locally. No occurrences of the Central Mount Stuart Beds have been observed east of Utopia Homestead. The basal oscillation-ripple marked sandstone has been observed at many localities on the Alcoota Sheet area and an estimated 1,000 feet of the dark red beds form conspicuous flat topped hills over an area of about a hundred square miles. A section of approximately 500 feet thick, has been measured by K.G. Smith at Mount Skinner, in the upper part of the preserved section of these beds, as follows:

Top of hill.

10 feet - greywacke; cross bedded, very coarse grained, dark red.

75 feet - greywacke; medium bedded, coarse grained, dark chocolate.

235 feet - greywacke; medium grained, dark red, with numerous mud pellets.

25 feet - greywacke-arkose; cross bedded, very coarse grained, with mud pellets.

53 feet - greywacke; medium to very coarse grained, dark red, with mud pellets.

17 feet - greywacke; medium grained, dark red, with mud pellets.

15 feet - concealed.

8 feet - sandstone; quartzose, medium grained, medium bedded, brown-grey, with mud pellets.

15 feet - concealed.

12 feet - greywacke-arkose; cross bedded, thin bedded, coarse to very coarse grained, with mud pellets and some red micaceous sandstone.

5 feet - greywacke; thin bedded, fine to medium grained, hard, dark chocolate.

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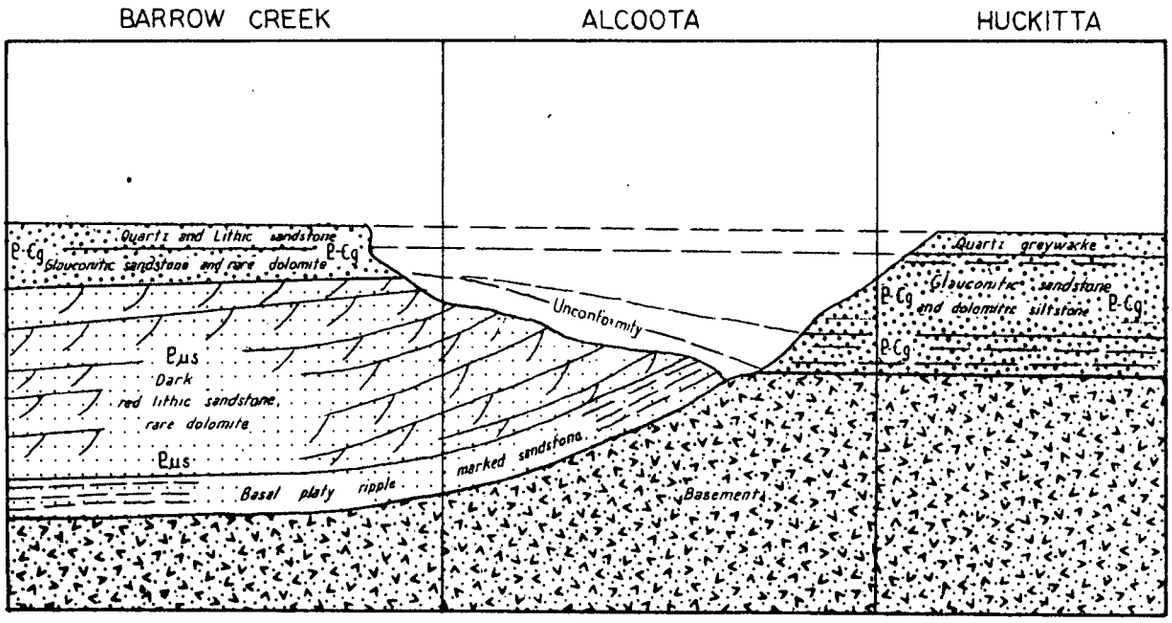
470 feet thickness of part section. The base is not exposed.

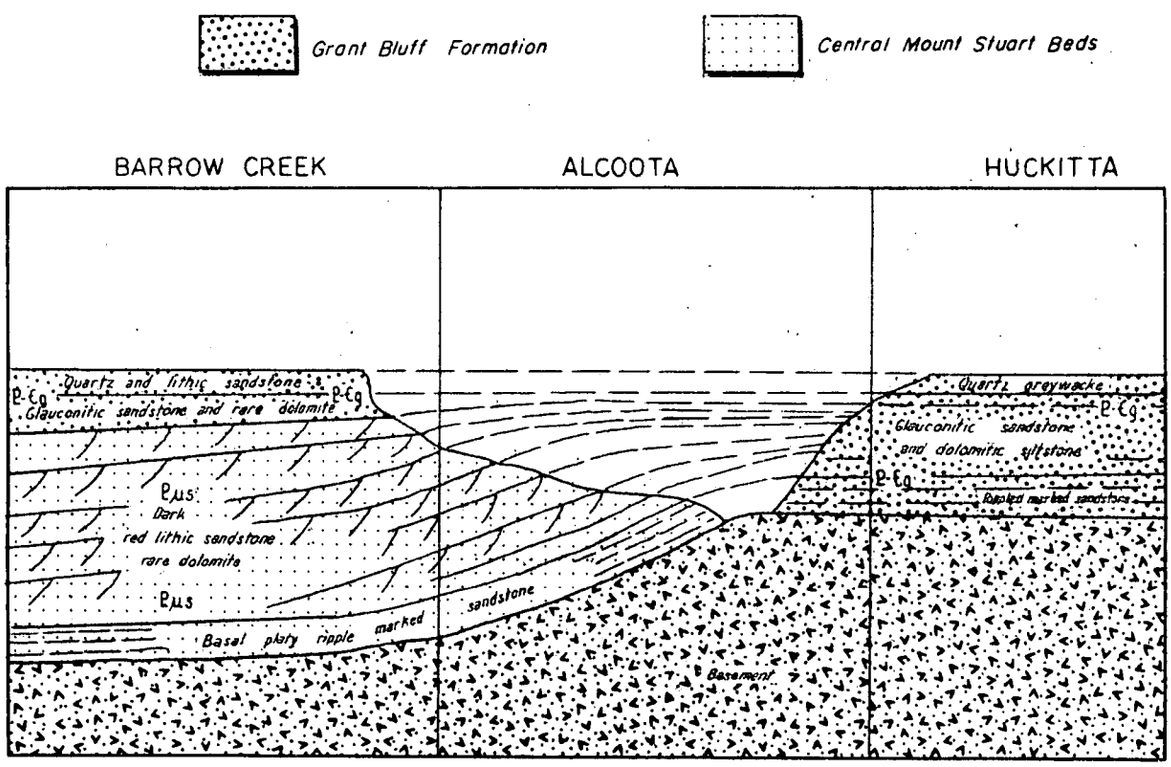
At a locality 8 miles north-west of Mount Skinner, a sequence of an estimated 80 feet of boulder beds and buff and chocolate siltstone with tillitic texture has been observed. The boulder beds have little matrix and contain boulders, cobbles and pebbles which are often highly polished and rarely, slightly faceted. The siltstones are massive and contain boulders, cobbles and pebbles from 1 inch to 3 feet in diameter.

Relationship to underlying rocks: The actual contact with underlying quartzites and porphyries of Lower Proterozoic age is seen in the Barrow Creek Sheet area; in the Alcoota Sheet area the Central Mount Stuart Beds overlie granite and Archaen metamorphics unconformably.

Fig. 4



Diagrammatic Representation of Alternative Interpretation of the Relation of Central Mount Stuart Beds (Pus) to Grant Bluff Formation (P-Cg)



Age: An Upper Proterozoic age is suggested for these rocks as they are overlain by fossiliferous Lower Cambrian glauconitic sandstone of the Grant Bluff Formation in the Barrow Creek Sheet area. They may be synchronous, in part, with arkose, shale and siltstone of the Elyuah Formation in the Huckitta Sheet area, which are known to underlie the Grant Bluff Formation. The boulder conglomerate and siltstone with tillitic texture are lithologically similar to beds in the Mount Cornish Formation in the Huckitta Sheet areas (Smith 1964), glacigene sediments reported by Noakes (1956) in the Field River area and the Areyonga Formation of the Macdonnell Ranges (Prichard and Quinlan, 1962) all of which are considered to be Upper Proterozoic in age.

The Grant Bluff Formation

The type locality of the Grant Bluff Formation is 10 miles south-east of Grant Bluff, on the adjoining Huckitta Sheet area, where Smith (1964) recorded 206 feet of quartz sandstone overlain by 235 feet of dolomite, siltstone, glauconitic sandstone and quartz greywacke and 82 feet of quartz greywacke.

The basal quartz sandstone unit crops out prominently and can be traced along a line north-west from the centre of the Huckitta Sheet. In the Alcoota Sheet area these beds (except for local reversals near faults) have north-east dips mostly less than 50 degrees and constitute the oldest beds on the south-west margin of the Dulcie Syncline (or perhaps a smaller parallel syncline) which continues north-west from the centre of the Huckitta Sheet across the Alcoota Sheet to the centre of the Barrow Creek Sheet. Outcrop of Grant Bluff Formation also occurs on the Alcoota Sheet area at the eastern end of the Hann Range, where over 270 feet of fine grained sandstone, with cross bedding and mudflakes and yellow weathering siltstone overlies more than 600 feet of an un-named Upper Proterozoic formation of pink, medium to coarse grained quartz sandstone with pebble bands. The quartz sandstone lies directly on basement.

In the north-east of the Alcoota area, the Grant Bluff Formation consists mainly of medium bedded, hard, white to grey quartz sandstone with common oscillation ripple marks and large mudflake casts. Approximately 200 feet of this lithology has been observed at Mount Michael, but at a locality 12 miles north-west, 20 feet of white quartz-feldspar conglomerate and quartz sandstone rests on basement and is overlain by dark red shaly siltstone. More extensive occurrences of the latter lithology under the sand cover are inferred from information from a water bore and from the distribution of purple chert gravel immediately north of many of the quartz sandstone outcrops.

Relationship to the underlying rocks: The actual contact has been observed between the Grant Bluff Formation and schists of the Arunta Complex and with Lower Proterozoic granites east of the Sandover River. No contact has been observed with the Central Mount Stuart Beds in the Alcoota Sheet area. Various interpretations of the relationship of these units are possible (fig.4).

1. The Central Mount Stuart Beds were deposited over the whole area and has later been eroded in the east before the Grant Bluff Formation was deposited.

2. The eastern area was an area of non-deposition during the time of deposition of the Central Mount Stuart Beds.

3. The Grant Bluff Formation on Huckitta and Alcoota Sheet areas is a time equivalent of both the Central Mount Stuart Beds and the overlying Grant Bluff Formation in the Barrow Creek Sheet area.

Palaeontology: No diagnostic fossils have been found in the Grant Bluff Formation in the Alcoota or Huckitta areas, but a Lower Cambrian Helcionella has been found in the Barrow Creek Sheet area in sandstone which has been correlated lithologically with the Grant Bluff Formation on the Alcoota and Huckitta Sheet areas.

UPPER CAMBRIAN - LOWER ORDOVICIAN

The oldest Palaeozoic outcrop on the Sheet area is considered part of the Tomahawk Beds. A core hole, B.M.R. Grg.1, drilled on the Huckitta Sheet area, 2 miles east of the boundary of the Alcoota Sheet, penetrated, at 118 feet below ground surface, 102 feet of possibly an older, non-cropping sequence of inter-bedded sandstone, siltstone and oolitic limestone dated by a fossil as Upper Cambrian (Milligan, 1963). The exact stratigraphic position is doubtful; it has some lithological similarities with the Arrinthrunga Formation which crops out further to the east and may be stratigraphically below the outcropping Tomahawk Beds.

The Tomahawk Beds

The name Tomahawk Beds was given by Smith (1964) to a sequence of richly fossiliferous sandstone, quartz greywacke, green siltstone, dolomite, limestone and oolitic ironstone of Upper Cambrian to Lower Ordovician age which crops out widely in the Huckitta Sheet area. In the west of the Huckitta Sheet area, the outcropping beds consist mainly of quartz sandstone which dips to the north-east along the southern flank of the Dulcie Syncline. These sandstone outcrops are continuous with outcrops in the Alcoota Sheet area.

Isolated outcrops of this sandstone occur as far north-west as the centre of the Barrow Creek Sheet area; some lie on the flank of the Dulcie Syncline and some form flat-lying outcrops farther south.

A section in these Beds, four miles north of Utopia homestead, is as follows:

Top of hill

40 feet - quartz sandstone; medium to coarse grained, clean, pink, with ripple marks, mud pellets and cruzianas

25 feet - quartz sandstone; silty, laminated, thin bedded, medium grained, hard grey, with glauconite, (Fossils* Alc.15 at 390 ft)

20 feet - quartz sandstone; silty, medium bedded, firm to friable, grey and brown: worm trails and pipe rock,

60 feet - quartz sandstone; medium bedded, hard, grey; cruzianas and pipe rock, (Fossils Alc.14 at 325 feet)

40 feet - quartz sandstone; thin bedded, fine to medium grained, brown and yellow; abundant trails, some pipe rock and ripples,

30 feet - quartz sandstone; silty, cross laminated, medium bedded, medium grained, white to brown, with glauconite, (Fossils Alc. 13 at 250 feet).

5 feet concealed,

60 feet - sandstone; laminated, medium to coarse grained, mostly soft, clean pink, grey and white, glauconitic. Some siltstone, pipe-rock and ripple marks, (Fossils Alc. 12 at 193 feet; Alc. 11 at 190 feet)

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* Fossil numbers refer to numbered collections held at B.M.R. Canberra.

35 feet - (including 5 feet concealed) sandstone; thin-bedded, medium grained, grey, and fine sandy silt with dolomite; dark brown, coarsely crystalline: pipe-rock and glauconite, (Fossils Alc.10 at 155 feet)

5 feet concealed,

20 feet - quartz sandstone; laminated, fine to medium grained, medium bedded, brown and bluff, glauconitic, with worm trails, (Fossils Alc. 9 at 110 feet).

5 feet concealed,

10 feet - quartz sandstone; cross-bedded, medium bedded, medium to coarse grained, friable, clean with worm trails,

5 feet - dolomite and chert; brown

38 feet - (including 10 feet concealed) quartz sandstone; thin to medium bedded, medium to coarse grained, soft, pink, silty, glauconitic, (Fossils Alc. 8 at 40 feet)

7 feet - sandstone and dolomitic sandstone; yellow, red and brown,

10 feet concealed,

25 feet - (including 8 feet concealed) sandstone; laminated, thin bedded, medium grained, hard and soft, cream and pink, glauconitic, (Fossils Alc. 7 at 0 - 12 feet)

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440 feet part section. The base is not exposed.

Fossils Alc. 7 and 8 are Upper Cambrian, Alc. 9 to 15 are Ordovician in age. (pers.comm., J. Gilbert-Tomlinson B.M.R.).

DEVONIAN

Dulcie Sandstone

The type locality of the Dulcie Sandstone (Smith, 1964) is in the Huckitta Sheet area. It forms the core of the asymmetrical Dulcie Syncline and its distribution is continuous with outcrop in the Alcoota Sheet area. Outcrop in the Alcoota Sheet area is continuous also with Dulcie Sandstone outcrop in the Barrow Creek Sheet area to the north-west.

The formation is composed of cross-bedded quartz sandstone with occasional beds of siltstone and pebble conglomerate; the sequence is considered to be of fresh water origin. It has a measured thickness of 2,070 feet in the Huckitta Sheet area and a measured thickness of 1,500 feet at a locality on the Barrow Creek Sheet area, 2 miles north of the Alcoota Sheet boundary.

Relationship to underlying rocks: In the Alcoota Sheet area, the Dulcie Sandstone has an unconformable relationship to the underlying Tomahawk Beds.

Palaeontology: No fossils have been found in the Alcoota Sheet area, but Upper Devonian fresh water placoderms have been recorded from 1640 feet above the base of the formation in the Huckitta Sheet area (Hills, 1959). Other placoderms have been collected from within a few feet of the local base of the Dulcie Sandstone in the Barrow Creek Sheet area (Smith and Milligan, 1964). These forms have been provisionally placed in the Middle Devonian (Opik, B.M.R. pers. comm.).

?TERTIARY

Arltunga Beds

Limestones, with irregular chert lenses and nodules and minor siltstone and sandstone, has a widespread development in the Alcoota Sheet area. It is correlated by lithology and outcrop distribution with the Arltungan Beds described by Madigan (1932) from the Plenty, Hale and Todd Rivers, east of Alice Springs. Smith (1964) examined these rocks in the Huckitta Sheet area and renamed them the Arltunga Beds, to conform with the Code of Stratigraphic Nomenclature.

Three major areas of these beds are known from the northern half of the Alcoota Sheet area.

1. Woolla Downs, Harpers Springs and Woodgreen. The outcrop in this area is continuous along a north-west line to the Hanson River which flows north at the western margin of the Barrow Creek Sheet area. These deposits are considered to have formed in a lake that occupied valleys of old major tributaries of the Hanson River.

2. Sandover River and Waite Creek valleys. Up to 60 feet of limestone and chalcedony is known from outcrop from between Utopia and Waite River homesteads.

3. 85 feet of limestone and brown and green siltstone and sandy limestone was found in the core-hole B.M.R. Grg. 1., drilled 2 miles east of the Alcoota Sheet boundary (Milligan, 1963). These rocks are covered by Quaternary sand, but are presumed to extend west into the Alcoota Sheet area, under the sand cover.

Palaeontology: No fossils have been found in the Arltunga Beds in the Alcoota Sheet area. However, Lloyd (1963) has recorded the presence of molluscs, foramenifera and an ostracod of Tertiary age in the Brunette Limestone, which is considered to be approximately equivalent to the Arltunga Beds due to similarity of lithology and outcrop distribution.

GEOLOGICAL HISTORY

LOWER PROTEROZOIC

Granites were intruded into the pre-existing rocks. Folding and further metamorphism probably took place at this time.

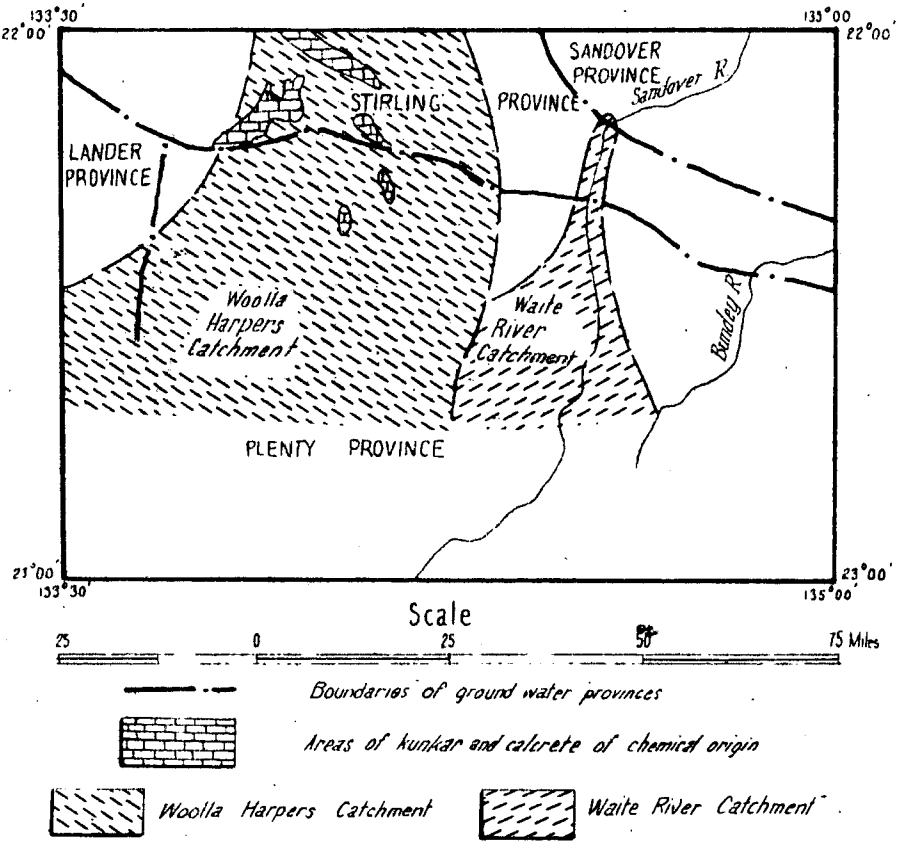
UPPER PROTEROZOIC

Following uplift and erosion of the pre-Upper Proterozoic basement rocks, the sandstones of the Central Mount Stuart Beds and the Grant Bluff Formation were deposited (see fig.4). It is possible that the Central Mount Stuart Beds infilled topographic lows in the basement relief and the Grant Bluff was deposited over both the Central Mount Stuart Beds and basement highs. Alternatively, the Central Mount Stuart Beds were deposited over the whole of the area and were later locally eroded down to basement before the deposition of the Grant Bluff Formation.

LOWER CAMBRIAN

Deposition of sandstone continued into the Lower Cambrian in neighbouring areas. Shallow water conditions prevailed, the Lower Cambrian sediments in the Barrow Creek Sheet area are glauconitic sandstone and red sandy siltstone with halite pseudomorphs, and in the western part of the Huckitta Sheet area, the Lower Cambrian sediments include much dolomite (some glauconitic) with red quartz sandstone, quartz greywacke and siltstone with halite pseudomorphs.

Fig. 5



Ground Water Provinces in the Northern Half of the Alcoota 1:250,000 Sheet and Location of Important Catchments (After Jones and Quinlan 1962)

MIDDLE CAMBRIAN

No definite Middle Cambrian sediments have been recorded in the region from west of 135°. East of 135°, Middle Cambrian sediments (Arthur Creek Beds and Sandover River Beds), are predominately shallow water fossiliferous limestones and siltstones. In the western part of the Huckitta Sheet area, however, a considerable amount of Middle Cambrian sandstone, siltstone and dolomite is present, perhaps indicating a shallowing in the direction of the Alcoota Sheet area.

UPPER CAMBRIAN-LOWER ORDOVICIAN

In the Huckitta Sheet area, interbedded limestone, oolitic limestone, siltstone and sandstone were deposited early in the Upper Cambrian. Following this, widespread deposition of glauconitic and fossiliferous sandstone (Tomahawk Beds) occurred. These sandstones are the earliest recorded from the Upper Cambrian in the Alcoota Sheet area.

LOWER ORDOVICIAN-LOWER DEVONIAN

Uplift and erosion occurred sometime before the Middle to Upper Devonian, when a thick sequence of fresh water sandstone was deposited (Dulcie Sandstone).

POST DEVONIAN - PRE-TERTIARY

No rocks are preserved from this period, so that no reconstruction of the geological history is possible.

TERTIARY

Limestone, with some sandstone and siltstone (Arltunga Beds), was deposited in fresh water lakes occupying the valleys of the larger river systems.

QUATERNARY - RECENT

Relative lowering of sea level has resulted in widespread erosion. The rate and type of sedimentation has fluctuated with climatic and sea level changes, so that significant accumulations, both of alluvium and dune sand, are present.

ECONOMIC GEOLOGY

UNDERGROUND WATER

Jones and Quinlan (1962) made a preliminary assessment of the value of underground water in the Alice Springs area and included the Alcoota 1:250,000 Sheet in the survey. The northern half of the Alcoota Sheet area includes part of four of their 'ground-water provinces', Sandover, Stirling, Plenty and Lander (fig.5). The water bores in the northern sector of the area where the aquifer has been fairly positively identified, are tabulated below, grouped under the respective ground-water provinces and their constituent aquifers, following Jones and Quinlan (1962). The full list of water bore information available is given in the appendix.

The depth groups in the following table are as follows: shallow - less than 100 feet; moderate - 100-250 feet; deep - over 250 feet.

The quality groups are as follows: good - under 1,500 p.p.m. total dissolved solids; moderate - 1,500-7,000 p.p.m; saline - over 7,000 p.p.m.

The supply figures are grouped as follows: good - over 1,000 gals. per hour; moderate - 500-1,000; poor - under 500.

Aquifers (of Jones and Quinlan 1962)	Number of bores in identified aquifers	Depth	Quality	Quantity
Sandover Province:				
Fractured & porous Upper Prot. & Palaeozoic sandstones	1 (? Up.Cambrian)	moderate	good	good
	1 (? Devonian)	?	?good	good
	4 (Quatern. alluvium)	shallow	good	3 good 1 poor
Stirling Province:				
Fractured & porous Palaeozoic sandstones	3 to ?5 (Central Mt.Stuart Beds)	moderate	moderate to saline	nil to poor
	2 (Grant Bluff Formation)	shallow to moderate	1 good	1 poor
			1 saline	1 good
Fractured & weathered zones - metamorphics	1 to ?3	moderate	moderate to/or saline	moderate to/or poor
	2 (granite)	shallow	good	poor
	1 (granite - Grant Bluff Contact)	?	good	good
	10 (Tertiary lst.)	shallow	good	good
	6 (Quat.alluv.)	shallow	good	good
Plenty Province:				
Weathered zones - metamorphics	nil			
minor basins and piedmonts	nil			
	2 (Tertiary lst. and chert)	shallow	good to moderate	good

Stock: The general requirements for a stock bore in the area is a supply of over 600 gallons per hour from a depth of less than 500 feet and total dissolved solids (T.D.S.) of under 7,000 parts per million. Almost all holes drilled in alluvium and Tertiary limestone fulfil these requirements; holes in other formations have a lower chance of success.

Irrigation: Jones and Quinlan (1962) give the figure of 0 - 1,500 T.D.S. as generally suitable for agriculture and mention that the Woolla - Harpers Catchment (fig.5) is worthy of detailed investigation in order to establish whether it can support a " .. limited irrigated agriculture". The Waite River Catchment is mentioned as having apparently less potential. Currently, lucerne is being irrigated successfully on a limited scale in this catchment.

PETROLEUM

It is not possible to make a complete assessment of the potential of the area due to lack of outcrop and surface information. It is apparent that the outcropping sediments are not prospective, due either to their stratigraphic position and induration (as in the Central Mount Stuart Beds and Grant Bluff Formation), or due to the lack of suitable traps (as in the case of the outcropping Tomahawk Beds).

In some part of the Upper Cambrian (i.e. the section in B.M.R. Grg.1, and perhaps in the lower unexposed section of the Tomahawk Beds) siltstone, sandstone and carbonate rock is present, and suitable reservoir and cap rock for hydrocarbon accumulation may occur. However, almost nothing is known of the thickness or structure of these sediments.

Middle Cambrian sediments in the neighbouring Huckitta and Elkedra Sheet areas are predominantly limestone, silty limestone and calcareous siltstone. These rocks are known to have some hydrocarbon content in at least two localities. At Ammaroo Station, in the Elkedra Sheet area, a water bore struck a limited quantity of wet gas in limestone of the Sandover River Beds (Mackay and Jones, 1956). In a core-hole, B.M.R. Grg. 6, silty limestone with a petroliferous odour was observed (Milligan, 1963). These rocks are generally tight, but could have been source beds for significant quantities of hydrocarbons.

The nearest outcrops of Middle Cambrian sediments to the Alcoota Sheet area are in the western half of the Huckitta Sheet area, but these are often sandstone and siltstone (Smith, 1964). It is possible, then, that there is a change from carbonate to non-carbonate facies towards the Alcoota Sheet area. Stratigraphic drilling is necessary to test this possibility, and also to test the thickness and lithologies of the lower unexposed Upper Cambrian section which might provide reservoir and trap rock in the area.

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APPENDIX

Logs of Water Bores

Woolla Downs

	Homestead	8-Mile Well	Cabbage Well	Stuart Well
Location (from hstd.)	0	7.0 NE	9.5 WSW	13 WSW
Total Depth	40	20	16	69
Standing Water Level		13	14	31
Water Struck at				
Pump Depth	24'6"			17
Date Drilled				
Supply				
Driller's Log				
Analysis *				
Date	10/8/56	26/10/59	23/8/61	23/8/61
T.D.S. (ppm)	1473	1588	1192	1525
Cl.	375	390	225	185
SO_4	180	184	141	133
F	1.4	1.1	1.8	3.0
Na	80	86	64	12
HCO_3	379	459	402	569
CO_3	0	0	0	0
Na	220	250	198	360
K	59	42	50	81
Mg	89	88	64	26
NO_3	40		61	139

Geological Comment All most probably in Tertiary sediments.

* Analyses by Animal Industry Branch, Northern Territory Administration.

Harpers Springs

	Homestead	Old Hstd	2-Mile Well	Ghost Well	Culdunda
Location (from hstd)	0	2 NW	3 NW	8 N	4S
Total Depth	50	11	20	20	30
Standing Water	20	10	17	17	22
Water Struck					
Pump Depth					
Date Drilled					
Supply					
Driller's Log					
Analysis					
Date	5/8/58	15/8/61	13/11/59	13/11/59	
T.D.S.	1335	1063	1113	1775	1167
Cl	360	193	178	565	240
SO_4	138	88	73	223	112
F	0	1.3	1.4	0.8	1.2
Ca	116	78	45	88	82
HCO_3	327	330	415	303	327
CO_3	0	0	0	0	0
Na	205	126	173	265	142
K	36	34	46	78	33
Mg	93	60	52	117	72
NO_3	60	153	30	135	158

Geological Comment All in Tertiary limestone

Harpers Springs (Contd.)

	(Bullock Paddock)? No. 2	Goofy	Old Bullock Paddock	Gidyea	Mt. Skinner
Location (from hstd.)	?	27 E	17.5ESE	22 ESE	18 ESE
Total Depth		100	220	100	
Standing Water		40			
Water Struck					
Pump Depth					
Date Drilled					
Supply		350 (1957)	nil	nil	
Driller's Log		limestone			

Analysis					
Date	22/8/55			"v. salty"	"v. salty"
T.D.S.	7469	2119			
Cl	3315	683			
SO_4	180	438			
F	2.0	0.7			
Ca	119	134			
HCO_3	600	369			
CO_3	0	0			
Na	1375	338			
K	31	20			
Mg	226	141			
NO_3		6			

Geological Comment

Goofy: Spudded and probably bottomed in Tertiary limestone.

Bullock Paddock and Mount Skinner: Probably Central Mount Stuart Beds.

No. 2 and Gidyea: Central Mount Stuart Beds or Archaean.

Utopia

	Hmstd.	Toma-hawk	3-mile	Sandhill	Native Camp
Location (from hstd.)	0	5NE	3 NNE	9.5 NE	1 SSW
Total Depth	70	53	100	175	
Standing Water		53'4"	40		
Water Struck			40		
Pump Depth			60		27
Date Drilled					
Supply					
Driller's Log			river sand	"poor" white chalky clay	sandstone
Analysis					
Date		15/8/61	22/8/60		22/8/60
T.D.S.	319	278	1604	2771	2979
Cl	0	10	425	905	958
SO_4	2	8	218	516	368
F	0	0.2	0.4	0.3	0.5
Ca	47	36	63	82	55
HCO_3	238	191	459	390	710
CO_3	0	0	0	0	0
Na	8	14	335	525	728
K	4	4	11	233	23
Mg	15	14	71	119	129
NO_3	5	1	22		7
NH_2					2
NO_2					trace
Si, Fe, Al oxides				1	

Geological Comment

Homestead, Tomahawk and 3-mile: Alluvium

Native Camp: Central Mount Stuart Beds

Sandhill: Possibly in weathered Tomahawk Beds

Utopia (Contd.)

No.14 Utopia Test. (Rumball)

	No.1	No.2&3	No.4	No.5
Location from (hstd.)	16.5 NE	2N	2N No.1	750'WSW No.3
Total Depth	125	83		127	100
Standing Water			43	47	53
Water Struck		1)57 2)76	47	1) 55 2) 94	
Pump Depth			63	ca 94	
Date Drilled				/11/60	/5/61
Supply			500	1)850 2)4000	

Geological Comment

No.14: Probably in alluvium

Utopia (Irrigation) Test Bores: Gravel and sand.

Utopia (Contd)	New Sandhill	22-Mile	Kurrajong: Homestead	Delmore Dns: Alec's	Waite Rvr: North Bore
Location	11NE	19.5	0	9NW	8N
Total Depth	105		135	116	100
Standing Water				90	
Water Struck			120	90	87
Pump Depth				110	
Date Drilled				/13/54	
Supply	good	poor	500	1000	
Driller's Log	"no sand"	granite	red sand	sandstone	black jasper
Analysis		"good water"			
T.D.S.				10844	1948
Cl				4685	578
SO_4				2081	250
F				9.8	1.4
Ca				293	105
HCO_3				376	457
CO_3				0	0
Na				2700	350
K				37	18
Mg				587	111
NO_3				76	78

Geological Comment

Kurrajong and New Sandhill: Probably in alluvium.

Alec's: Upper Proterozoic sandstone.

North Bore: Tertiary chalcedony and limestone.

22-Mile: Granite at shallow depth.

MacDonald Downs - Derry Downs: Govt:

	Drought Relief	Dud	Dud	Ledan Peak No.6	No.7
Location from (hstd.)	13WNW	12 WNW	11WNW	6.5SE Utopia Hstd	15NE Utopia Hstd.
Total Depth		100	280	186	150
Standing Water		80	100	70	90
Water Struck					
Pump Depth					
Date Drilled		1958		/12/48	/11/48
Supply		v.small	v.small	672	'v.good'
Driller's Log	shale, alluvium, quartzite, granite. granite			clay, ironstone, gravel	sand, gravel limestone
Analysis	"good water"	"v.good"	"good"	10/8/55	
T.D.S.				5487	
Cl				2355	
SO_4				1090	
F				0.88	
Ca				294	
HCO_3				290	
CO_3				0	
Na				1000	
K				41	
Mg				394	
NO_3				22	

Geological Comment

Drought Relief: Granite/Grant Bluff contact.

Two duds: Weathered granite.

Govt:(Ledan Peak)No.6: Weathered Archaean schists.

No.7: Devonian Dulcie Sandstone outcrop a few hundred yards away.

AUSTRALIA 1:250,000

ALCOOTA
NORTHERN TERRITORY

1:250,000 GEOLOGICAL SERIES SHEET SF 53-10

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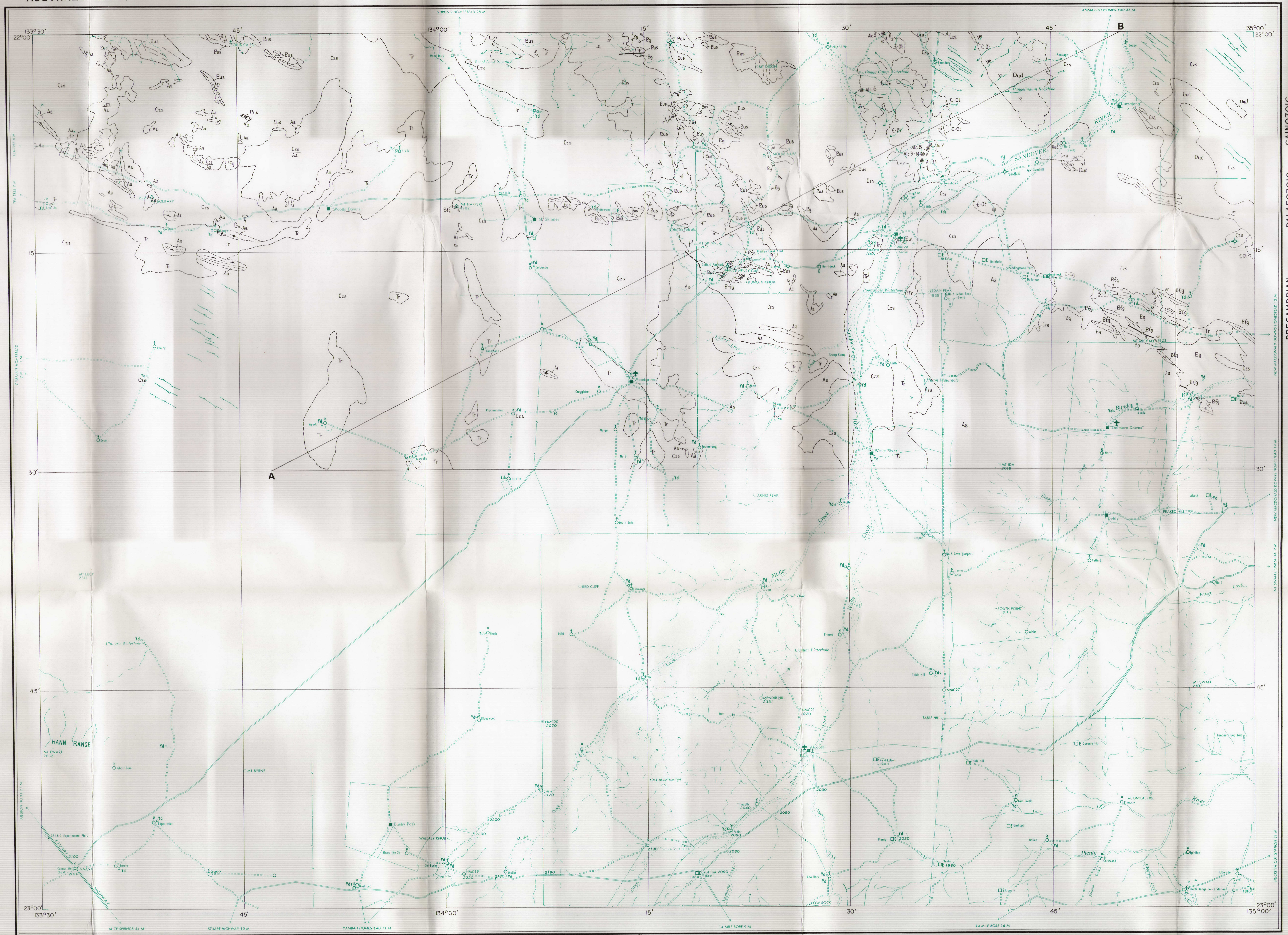


Reference

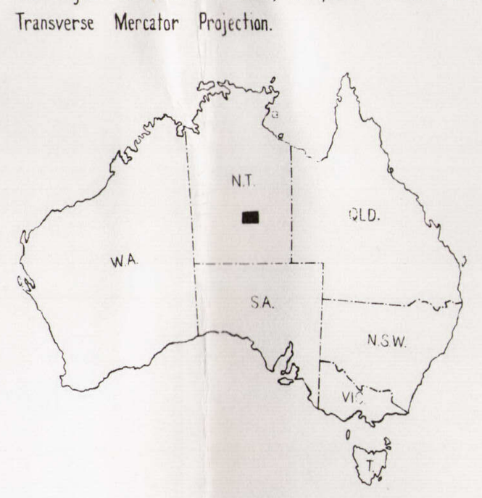
Era	Period	Unit	Symbol	Description
CAINOZOIC	UNDIFFERENTIATED		Czs	Aeolian and alluvial sand.
CAINOZOIC	TERTIARY		Cza	Soil and alluvium.
		Arltunga Beds	Tr	Silicified limestone, sandstone.
PALAEOZOIC	DEVONIAN	Dulcie Sandstone	Dud	Quartz sandstone, pebble lenses.
PALAEOZOIC	LOWER ORDOVICIAN TO UPPER CAMBRIAN	Tomahawk Beds	Є-Ot	Sandstone, glauconitic sandstone, siltstone and dolomite.
PRECAMBRIAN	UPPER PROTEROZOIC	Grant Bluff Formation	P-Єg	White and red ripple-marked sandstone, red shaly siltstone.
PRECAMBRIAN	UPPER PROTEROZOIC	Central Mount Stuart Beds	Pus	Dark red lithic sandstone and arkose. Pink ripple-marked sandstone, boulder beds.
PRECAMBRIAN	LOWER PROTEROZOIC		Pg	Granite.
PRECAMBRIAN	LOWER PROTEROZOIC	Mt. Swan Granite	Pgs	Biotite granite.
PRECAMBRIAN	ARCHAEAN	Arunta Complex	Aa	

Geological boundary.
Fault
Where location of boundaries, folds and faults is approximate, line is broken; where inferred, queried; where concealed, boundaries and folds are dotted; faults are shown by short dashes.
Strike and dip of strata.
Horizontal strata.
Prevailing dip of gently folded strata.
Dip < 15° / Dip 15°-45° / Dip > 45° / Trend of bedding — Air-photo interpretation
Strike and dip of foliation
Vertical foliation
Dip indeterminable
Quartz vein
Joint pattern - Air photo interpretation
Alc. 2 Macrofossil locality

Non-flowing bore with windpump
Abandoned bore
Well and windpump
Waterhole
Earth tank or dam
Sand dunes

Highway
Road
Vehicle track
Fence
"Alcoota" Homestead
Landing ground
Yd Yard
N.M.C. 27 Astronomical station
Trig. station
·2080′ Height in feet, instrument levelled
·2101′ Height in feet, barometric
(datum mean sea level)

Compiled and issued by the Bureau of Mineral Resources, Geology and Geophysics, Department of National Development. Topographic base compiled by the Division of National Mapping, Department of National Development. Aerial photography by the Royal Australian Air Force; complete vertical coverage at 1:46,500 scale. Transverse Mercator Projection.



INDEX TO ADJOINING SHEETS
Showing Magnetic Declination

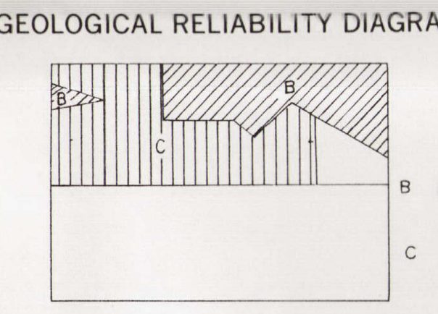
MT SOLITAIRE SF 52-4	LANDER RIVER SF 53-1	BONNEY WELL SF 53-2	FREW RIVER SF 53-3	AVON DOWNS SF 53-4
MT THEO SF 52-8	MT PEAKE SF 53-5	BARROW CREEK SF 53-6	ELKEDRA SF 53-7	SANDOVER RIVER SF 53-8
MT DOREEN SF 52-12	NAPPERBY SF 53-9	ALCOOTA SF 53-10	HUCKITTA SF 53-11	TOBERMORY SF 53-12
MT LIEBIG SF 52-16	HERMANNSBURG SF 53-13	ALICE SPRINGS SF 53-14	ILLOGWA CREEK SF 53-15	HAY RIVER SF 53-16
LAKE AMADEUS SG 52-4	HENBURY SG 53-1	RODINGA SG 53-2	HALE RIVER SG 53-3	SIMPSON DESERT NORTH SG 53-4

QUEENSLAND
ANNUAL CHANGE 1.30′ E

Scale 1 : 250,000

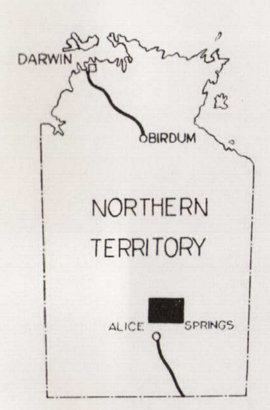
5 0 5 10 15 MILES
5 0 5 10 15 20 25 KILOMETRES

GEOLOGICAL RELIABILITY DIAGRAM



B Detailed reconnaissance - numerous traverses with air-photo interpretation.
C Reconnaissance - mainly air-photo-interpretation.

Geology 1961 by :- K.G. Smith, E.N. Milligan.
Compiled 1961 by :- K.G. Smith, E.N. Milligan.
Drawn by :- N.L. Kruger.



Section A-B

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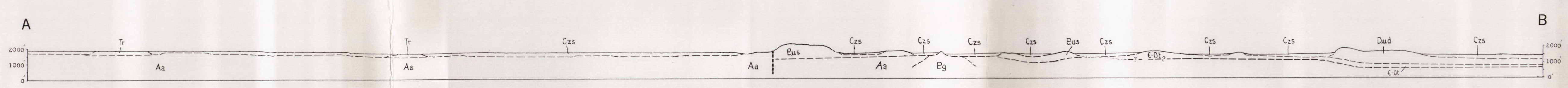

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