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THE GEOLOGY OF THE BETOOTTA 4-MILE SHEET AREA,
WESTERN QUEENSLAND

by

W. Jauncey

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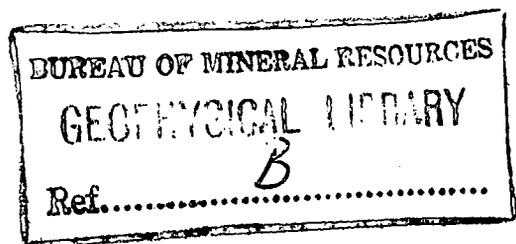
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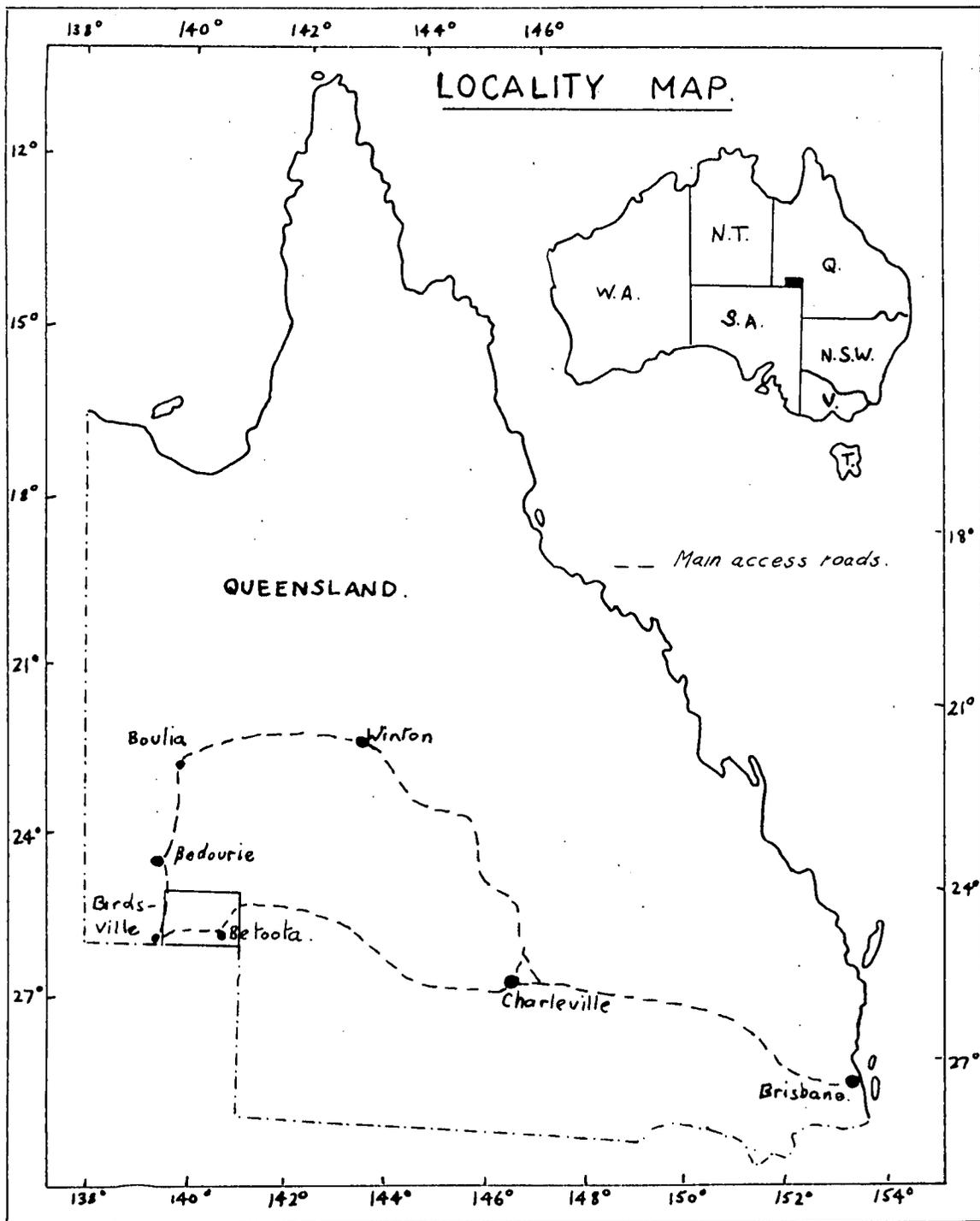


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Figure 1.



Cretaceous and Tertiary rocks are exposed over the total area of nearly 7,000 square miles. Surface and sub-surface information reveals 6,000 feet of Mesozoic sediments and 30 feet of Tertiary rocks. The topmost beds are much-weathered and silicified. In the south-east near Betoota there is a broad, elongate dome, and some minor structural trends to the west. A deep bore (9,824 feet) was drilled in the Betoota Dome in 1960 by Delhi-Frome-Santos, but failed to find economic quantities of oil or gas. The bore bottomed in steeply dipping red and green conglomerates of pre-Jurassic age. There is one artesian bore in the area, and several attempts to find supplies of sub-artesian water have been unsuccessful.

INTRODUCTION.

A reconnaissance survey of the Betoota 4-mile Sheet area, W. Queensland, was carried out by geologists M.A. Reynolds, F. Olgers and W. Jauncey, of the Bureau of Mineral Resources, during August and September, 1960. Traverses were made over most of the area; only the channel country of the Diamantina River proved totally inaccessible. Field observations and traverses were supplemented by aerial photograph interpretation. The aerial photographs were taken by Adastral Ltd. in 1958, at a scale of about 1:50,000. 1-mile photo-mosaics, prepared by the National Mapping Section of the Department of the Interior, were used, in addition to 4-mile base maps, showing surveyed heights, prepared by the Surveying Section of the Department of the Interior.

There are four homesteads in the area, Roseberth (The Bluff), Durrie, Mt. Leonard and Mooraberrie, and a hotel at Betoota. Population of the area is about 50. The main industry is raising of cattle of which there are about 35,000 head in the area. The main roads are the graded tracks from Bedourie to Windorah and Betoota (via Mooraberrie), and from Birdsville to Betoota and Arrabury. They are frequently impassable in wet weather.

The winter is characterised by winds, often cold, from the south and south-west, dry conditions and frequent dust-storms; there is also considerable diurnal variation in temperature. Summer, by contrast, is very hot and comparatively wet, with winds from the north and north-west and rain from tropical depressions and local thunderstorms. The average annual rainfall is 7 inches. Although the area

lies to the south of the monsoon belt, the Diamantina River sometimes becomes flooded during the summer with waters from the north.

Vegetation is sparse over most of the area, and is mainly saltbush, spinifex, and gidyea trees. Coolabah and other large trees grow along the main channels and water-holes of the river, and lignum is thick along most channels.

The area forms part of Queensland Authorities to Prospect 66P and 67P, held by Santos Ltd. and Delhi Australian Petroleum Ltd.

PREVIOUS INVESTIGATION.

Whitehouse (1940) described the Tertiary limestone at Cacoory Ruins. Detailed investigation of the Betoota Dome was carried out by geologists of Geosurveys Aust. Ltd. prior to the drilling of Delhi-Frome-Santos Betoota No. 1 Bore, and two 1-mile maps were produced covering the whole structure (Geosurveys Aust. Ltd., Sept. 1958). Sprigg (1959) carried out a photographic interpretation of the whole 4-mile Sheet area. Wopfner (1960) also described the Betoota Dome.

The South Australian Department of Mines carried out a seismic survey in the area in 1960.

PHYSIOGRAPHY.

The following three distinct regions will be discussed.

1. The area north and west of the Diamantina River.
2. The Diamantina channel country.
3. The gibber-plains south and east of the river.

1. The area north and west of the Diamantina has small rounded hills of arkosic sandstone and siltstone of the Winton Formation, with intervening plains of clayey and, in places, swampy soil. Patches of ironstone are common. Bilpamorea Claypan is an expanse of hard-packed white clay, 10 miles wide and nearly 30 miles long, aligned roughly east-west; its western margin is fringed with ironstone patches, whereas in the east it merges with the alluvium of the river channels. There is very little vegetation, the only trees are those which grow along the creek banks. The creeks are shallow and meandering, ending either in the Bilpamorea Claypan or the Diamantina River.

2. The broad swathe of country occupied by the Diamantina River consists of a maze of channels of varying depth which can be negotiated only on horseback, and are

completely impassable in the wet season. Dense lignum growth, muddy, water-filled channels and, in the middle of the river, sand-dunes, render this area virtually inaccessible.

3. The undulating, brown, gibber-plains extend south and east of the river and give the countryside a very barren appearance. In places breakaways occur, exposing the underlying Winton Formation. The highest ground in the area is in the south-east, where the limbs of the Betoota Dome form long cuervas aligned north-east - south west. From the dome the ground falls away in all directions, reaching its lowest levels near the Diamantina River. The flanks of the fold are deeply dissected by creeks, particularly in the west. The courses of these streams are marked by trees, mainly gidyea, although coolabahs line the banks of the larger ones.

Permanent waterholes are uncommon in this region; however, in 1960 considerable quantities of water were noted in Betoota and Oakes Waterholes, in the main channel of Brown's Creek some 7 miles north of the South Australian Border fence.

Sand-dunes.

Sand-dunes are quite common over the 4-mile Sheet area in general, even in the channel country, but are particularly common in the east. Large tracts of country south of Mooraberrie and at the southern end of the Betoota Dome are covered in sand. The dunes to the west are less extensive and easier to negotiate; they occur as elongate ridges, up to 30 miles in length and 40-50 feet high. The dunes at the southern end of the Betoota Dome, however, have a reticulate arrangement, but alignment of the sand-ridges, north-north-west, is the same as that of those in the Simpson Desert, 40 miles to the west.

Drainage.

This is a region of low average rainfall (7 inches per year), nearly all of which falls in the summer months from December to March. Because the country is flat flooding occurs and run-off is slow. The main drainage is by the Diamantina River, which flows south-west almost to Birdsville and then south to Lake Eyre. Generally however, much of the surface water does not travel far; evaporation and absorption account for much of it. Deep levels of chemical weathering encountered in many bores in the general area (down to 300 feet below the surface) suggest that a good deal of water seeps down from the surface each year.

TABLE I.

STRATIGRAPHY AND TECTONIC HISTORY

ERA	PERIOD	STRATIGRAPHICAL UNIT	STRAT. SYMBOL.	LITHOLOGY	MAX. THICKNESS.	OCCURRENCE	TECTONIC HISTORY	CORRELATION		
CAINOZOIC	Quaternary (Recent)		Cza Czs Czg	Alluvium. Wind-blown sand. Gravel (gibbers).		Alluvial Flats Sand dunes Gibber Plains (Stony Desert)		Late Tertiary-Recent " " " "		
	TERTIARY	Tertiary Limestone	Tl	White, hard, crystalline, limestone, usually highly silicified and mainly chalcedonised.	5'-10'	As outcrop in region of Caccory Bore; elsewhere as fragments.	Deposited in depressions, subsequently silicified and resisted erosion.	Austral Downs Limestone.		
		Marion Formation	Tm	Silicified fine-grained conglom., fine-grained sandstone and siltstone.	30'	Outcrops on top of Ettoota Dome, in gibber plains as result of erosion.	Deposited on ?already folded Mesozoic. Folded in ?mid-Tertiary.	?Myrian Series.		
		Winton Formation	Ku?w	Kaolinised arkose, with interbedded clay and siltstone; some limonitic bands and calcareous horizons. Freshwater sequence.	1300'	100' in outcrop; rest in bores.	Folded (?) in late Cretaceous times; eroded, overlain by Tertiary and folded again.			
	CRETACEOUS	Upper ?Cenomanian	Wilgunya Formation	Klw	Marine sequence of blue/grey shales, fossiliferous limestone and sandy calcareous beds.	2000'	Bores	Folded after deposition of Winton Formation.	Rona and Bambo Formations.	
		Lower Neocomian.	Longsight Sandstone Equivalent	Kll	Sandstones, sandy siltstones, and claystones.	200'	Bores	Not known	Longsight Sandstone ? ?	
	MESOZOIC	JURASSIC	Middle - Upper BLYTHESDALE GROUP	Nocya Sandstone		Fine to medium-grained, clean, quartz sandstone; tight to medium porosity; dark grey micaceous shale.	Ca. 800'	D.F.S. Ettoota No.1 Bore.		
				Fossil Wood Beds		V. fine to fine grained quartz sandstone with dark brown to grey very lignitic, silty shale. Some coal seams.	250'	D.F.S. Ettoota No.1 Bore.		
				Gubboramunda Sandstone		Very coarse grained quartz sandstone, good porosity shale streaks.	500'	D.F.S. Ettoota No.1 Bore.		
		Pre - Jurassic	Lower	Walloon Coal Measures		Coarse-grained to conglomeratic sandstone with very lignitic shale. Trace coalified wood.	750'	D.F.S. Ettoota No.1 Bore.	Unconformable on Pre-Jurassic	
Jurassic					Red/green coarse to conglomeratic sandstone; steep dips, sheared.	1500'+	D.F.S. Ettoota No.1 Bore.	Much tilted/folded; 70°-80° dips. Eroded before deposition of Mesozoic.	Devonian, pre-Cambrian?	

STRATIGRAPHY.

The stratigraphy and tectonic history is presented in Table 1. Although details of Jurassic and pre-Jurassic strata are shown, they are known only from D.F.S. Betoota No. 1 Bore, and do not appear anywhere at the surface; only formations of Cretaceous and younger age are described in the text. Correlation of bores in the area is shown in Appendix I (b).

Longsight Sandstone Equivalent

Basal Cretaceous sandstones have been recorded in both Cacoory artesian bore and D.F.S. Betoota No. 1 bore. At Betoota, 200 feet of light grey, very fine-grained, sub-angular, quartz sandstone with dark grey, hard, splintery shale were found to lie conformably on (and may form part of) the freshwater Blythesdale Group. They are described in the Well-Completion Report as Transition Beds of Neocomian age. Cacoory bore bottomed in just over 100 feet of white and black sandstone with some shale.

These sandstones are probably equivalent to the water-bearing Longsight Sandstone formation, which is to be found to the north in the Boullia area. Casey (1959) described the Longsight Sandstone as a quartz sandstone, red-brown, ferruginous and micaceous; conglomeratic towards the base, silty towards the top. The Longsight Sandstone in the north rests with angular unconformity on Precambrian and Lower Palaeozoic rocks.

Wilgunya Formation.

About 2,000 feet of Lower Cretaceous marine sediments have been found in the Betoota Bore. The sequence consists mainly of micaceous, carbonaceous and calcareous shales, with some limestone and sandstone bands. Macrofossils and Inoceramus, Aucellina; microfossils include Globigerina and, near the base, Verneuilina howchini.

A similar thickness of marine shales is recorded in the log for the artesian bore at Cacoory Ruins.

The Wilgunya Formation is not exposed anywhere at the surface, but crops out to the north in the east of the Machattie 4-mile Sheet area, where it forms soil plains strewn with calcareous sandstone boulders. The lower part of the Wilgunya Formation, conformably overlying the Longsight Sandstone, is similar lithologically and palaeontologically to the Roma Formation, and the upper part, conformably overlain by the Winton Formation, is similar to the Tambo Formation.

The name Wilgunya Formation was proposed by Casey (1959) for a series of Lower Cretaceous claystone and siltstone with sandstone and sandy siltstone beds which conformably overlies the Longsight Sandstone, and contains forams, microplankton, sporomorphs and some radiolaria; macrofossils including Inoceramus and Aucellina, and other fossils similar to those found in the Tambo Formation. The type area is at Lat. 22° 32' S., Long. 140° 50' E., 8 miles north-east of Dover Homestead.

Winton Formation.

The main outcrop of Winton rocks is to be seen north and west of the Diamantina River. Small, rounded hills of arkose predominate, with occasional siltstone bands. Almost without exception the feldspars have been kaolinised, giving the rock a speckled white and pink appearance. Limonite nodules, seen in other areas as irregular bands, have here broken down to small fragments which cover the ground in large ironstone gravel patches. South of the river the Winton Formation is largely covered by Tertiary sandstones (mostly silicified) and derived gibbers. It crops out well in scarps of the breakaways near the Betoota Dome, where the following section was measured:-

Tertiary	
0'-20'	<u>Sandstone</u> ; silicified, yellow-brown, fine-grained, much weathered.
Disconformity	
Cretaceous	
20'-55'	<u>Arkose</u> ; partly silicified, kaolinised.
55'-57'	<u>Siltstone</u> ; white, unsilicified, with iron-rich laminations.
57'-63'	<u>Arkose</u> ; pink, unsilicified.
At 63'	<u>Arkose</u> ; iron rich very thin band.
63'-90'	<u>Arkose</u> ; pink, kaolinised, unsilicified.
90'-93'	<u>Siltstone</u> ; white-yellow.
93-103'	<u>Arkose</u> ; mainly purple.
103-104'	<u>Siltstone</u> ; sandy white-yellow.
104-150'	No outcrop; scree until gibber plain is reached.

Above the marine shales of the Lower Cretaceous, the log for Cacoory Bore records about 600 feet of sediments which, although chemically weathered in higher strata, can be interpreted as siltstones and sandy siltstones of the Winton Formation. At Betoota, the thickness is considered to be 1300 feet. This indicates a thickening of the Winton Formation from north-west to south-east. To the north in the Machattie 4-mile Sheet area, the Winton Formation thins to less than 50 feet, glauconitic sandstone was noted at the base of the Winton

Formation in the Betoota Bore.

Wopfner (1960) has taken the Betoota Limestone as a marker band in the Winton Formation. This was observed in one place, 7 miles S.E. of Betoota. The Winton Formation lies conformably on the Wilgunya Formation, but was eroded and probably folded before the deposition of the Tertiary.

Dunstan (1916) used the name "Winton Series" for Cretaceous rocks in the Winton area. Later (1922) he suggested that their age was "Cretaceo-Tertiary". Whitehouse (1930) put the "Winton Series" conformably above the "Tambo Series" and gave it a tentative Cenomanian or Turonian age. Subsequently (1954) he placed the Winton Formation in the Rolling Downs Group and gave its age as Cenomanian or later. Recent palynological work (Evans, 1961) has shown that the Winton Formation is no younger than Cenomanian and may even be partly Albian.

Marion Formation.

The Marion Formation crops out only along the tops of the scarps of the Betoota Dome. Between 20 and 30 feet of yellow-brown, fine-grained, silicified sandstone form small, vertical cliffs, notably on the eastern scarp. Elsewhere the Tertiary sandstones have broken down to form gibbers, which cover most of the area south and east of the Diamantina River. The lithology of the gibbers is variable; they are all highly silicified, and are composed of fine-grained sandstone to conglomeratic sandstone, with large quartz fragments and some chert fragments, in a finer-grained matrix.

The Marion Formation rests on the eroded surface of the Winton Formation. In the Morney Anticline to the east of this area (Wopfner, 1960) there is a 2° unconformity between the Tertiary and the Cretaceous. Casey (1959) proposed the name Marion Formation for a sequence of unsorted sandy quartz, siltstone and fine silicified conglomerate. The type area is Lat. 22° 40' S., 139° 47' E., 14 miles west of Marion Downs Homestead (Mt. Whelan 4-mile Sheet area). The unit is probably equivalent in age to the "Eyrian Series" of sandstone in South Australia.

Australian Downs Limestone.

About 10 feet of white, hard, micro-crystalline limestone crop out in an east-north-east trending ridge south of Cacoory Bore; it is silicified near the top, and in places it is replaced by chalcedony. Examination of thin sections has shown that the limestone is almost pure, micro-crystalline calcite, with vugs lined with larger, subhedral crystals of calcite. Replacement of calcite by quartz increases towards the top of the formation. No fossils were found. Similar limestone and chalcedony scree occurs as large patches south

of the Diamantina River and near the South Australian Border fence. These iron-stained fragments can be easily mistaken for sandstone gibbers unless viewed in the hand.

These limestones have been called Austral Downs Limestone because of ~~its~~^{their} similarity to limestones further to the north. The Austral Downs Limestone was named by Noakes and Traves (1954) and described as follows:

"This limestone is represented by scattered fragments of skeletal material with an irregular silica content." The type area is in the Georgina Valley at Austral Downs and Urandangi. Other Tertiary limestones are described by Casey et al. (1960) and Paten (1961).

Gibbers.

These are found mainly south of the Diamantina River. They are rounded and usually polished fragments of rock which vary in diameter from 2" to 8", the average size being 4". They are all highly silicified and almost invariably are stained on the surface with red-brown iron-oxide.

Sand-dunes.

About 15% of the surface area is covered by aeolian sand in the form of long north-north-west trending dunes or ridges. The sand is poorly sorted and angular, and iron-oxide coating of the individual grains has given the dunes a distinctive red colour.

Alluvium.

Shallow holes drilled by the South Australian Department of Mines during their 1960 seismic survey in this area have disclosed at least 65 feet of alluvium near Roseberth. The alluvium is mainly sand, clay and silt, and completely covers the wide tract of the Diamantina River channel country. Alluvium is also found in the courses of other large creeks, and in shallow, swampy depressions such as Moonda Lake and Did-itchie Lake. Bilpamoreya Claypan possibly represents a flood lake now almost cut off from the Diamantina River (Whitehouse, 1948).

GEOLOGICAL HISTORY

Little, if any, break occurred in sedimentation between the Jurassic and Cretaceous. The Logsight Sandstone Equivalent lies conformably on, and is probably equivalent in part to, the freshwater Blythesdale Group and passes gradually into the marine Wilgunya. Sedimentation in the Wilgunya sea was slow. The change to the freshwater conditions of Winton deposition was probably gradual, as indicated by the presence

of glauconitic sandstone at the base of the Winton Formation. The whole of the Betoota 4-mile Sheet area was submerged throughout the deposition of the Wilgunya and Winton Formations.

Erosion followed the drying-up of the Winton sea, and evidence from other areas (Wopfner, 1960) indicated that slight folding occurred during this period. After further erosion, the Tertiary sandstones were laid down on the planed surface of the Winton Formation. The distribution of the Marion Formation, when considered in conjunction with areas to the west and north, indicates that deposition occurred in a shallow lake or river environment, with possibly some aeolian deposition (Casey et.al., 1960).

Lateritisation and deep weathering is evident over the whole area. The age of these processes is not certain, but is probably post-Marion Formation. The age of the Tertiary limestone is not certain but in the Boulia area (Casey et.al., 1960) it overlies, at least in part, the Marion Formation. Since the deposition of the Tertiary units, they have undergone a high degree of silicification.

STRUCTURE

The major structure of the area is the Betoota Dome. It is a broad north-north-east trending fold with dips of 3-4 degrees; the axis is slightly curved, and the crest has been eroded, leaving Tertiary-capped scarps and some isolated mesas, and gibber-covered Cretaceous sediments between the scarps. Dips to the west of the dome have revealed some lines of possible structure. They may represent small folds, faults or joint patterns. However, they should be treated with caution, for dips in the silicified sediments of the duricrust may be due to impregnation with silica at an angle to the attitude of the beds, or may simply be surface slopes resulting from erosion.

Milton and Seedsman (1961), from seismic evidence, have suggested that there may be slight anticlinal folding south-east of Roseberth Homestead. The Bureau of Mineral Resources (Geophysical Section) gravity survey of 1957-1959 disclosed a major trend in gravity anomalies crossing the Betoota 4-mile Sheet area from north-east to south-west, almost parallel to the Diamantina River. This trend is parallel to the edge of the Boulia Shelf to the north-west (represented by a gravity anomaly high axis).

ECONOMIC GEOLOGYPetroleum.

Late in 1959, Delhi Australian Petroleum Ltd., together with Santos Ltd. and Frome-Broken Hill Ltd., drilled a subsidised exploratory oil well in the crest of the Betoota Dome. Total depth was 9824 feet, the bore ending in steeply dipping red and green conglomerates of pre-Jurassic age, possibly Devonian or Precambrian. Gas was detected in the Mooga Sandstone and oil in the Walloon Coal Measures, but in both instances drill-stem tests were negative. There is no other record of oil or gas in this area. The nearest source beds are the Lower Palaeozoic rocks to the north in the Georgina Basin, and the dark marine shales of the Wilgunya Formation; the Cretaceous Longsight Sandstone has reservoir potentialities. However, no bore in the general area has struck oil or gas.

Water.

One artesian bore, Cacoory Bore, derives good water-supply from the sandstones below the Cretaceous marine shales. The rate of flow is controlled at 504,000 gallons per day. A bore drilled 400 yards south of the oil-bore at Betoota obtained a small supply of artesian water from Jurassic sandstones. Two sub-artesian bores 12 miles south of Mt. Leonard Homestead have tapped water from the base of the Tertiary sandstones; a sub-artesian bore 4 miles S. of Mooraberrie produces water from an unknown depth and lithology. Many other attempts have been made to find useable sub-artesian water, but have all failed (see ^{Appendix} ~~Table 2~~ and Figure 2.). Good ground water is available at Glenly Well, 24 miles south-east of Roseberth; salty water was struck in Ringamuura Well, 8 miles further east.

Surface water is held in the waterholes (e.g. Nerathella, Cooningheera and Parakunda) along the course of the Diamantina River and, except in times of extreme drought, is permanent. In the severe drought of 1952, the only standing water on Mt. Leonard property was in Paracoola Waterhole, which has never been known to be dry. In some places earth tanks have been constructed to trap water from creeks, but the supply fails quickly in dry conditions. Water remains for only a very short time in Moonda and Diditchie Lakes and the Bilpamorea Claypan.

Building Stone and Road Metal.

Cacoory Homestead was constructed about 50 years ago of the Tertiary limestone which is so abundant in the surrounding country. The walls, even today, show no signs of crumbling. The hotel and Customs Post at Betoota are built of locally

quarried sandstone. Apart from these instances stone is not used at all for building. Crushed gibbers are used to make causeways where large creeks cross the main roads.

Other Minerals.

No other minerals of economic value are present in the area.

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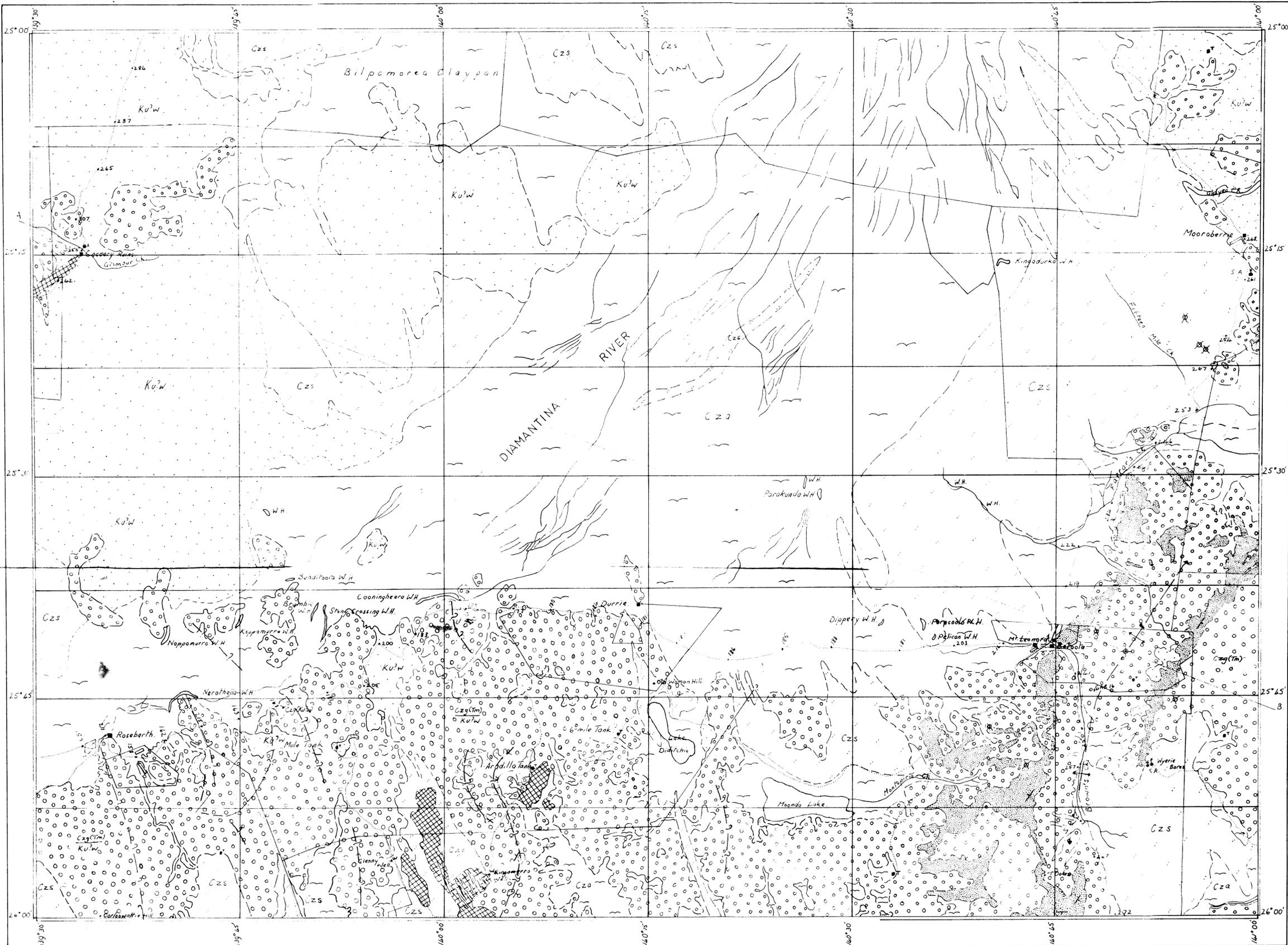
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BETOOTA 4-MILE SHEET AREA

Name of Bore (Station)	Registered Number	Position	Artesian (A) or Sub-artesian (S.A.)	Depth (Ft.) Water Struck	Depth (Ft.) Water Rose to	Supply (Gallons per day)	Quality	Driller and Year Drilled
Cacoory Bore (Roseberth)	12177	¼ mile N. of ruins of Cacoory Homestead; 70 miles S. of Bedourie on Bedourie-Birds- ville road.	A.	195 560 2590, 2615,) 2620, 2640,)	30 30 Surface	? ? 504,000	Salty Salty Good	Richardson Godfrey Brothers 1954.
Cacoory Dud Bore (Roseberth)	6858	1½ miles E.S.E. of Cacoory Bore	S.A.	45 180,378	? ?	? ?	Fresh Salty	J. Shepley 1938
Delhi Well No.1 (Mt. Leonard)	14000	1 mile W.S.W. of Betoota	S.A.	86 380	23 80	ca. 8400 2400	Bad Bad	Delhi Australian Petroleum Co.Ltd. 1959
Delhi Well No.2	14001	4 miles E.N.E. of Betoota	S.A.	50	?	?	Salt	Delhi Australian Petroleum Co.Ltd. 1959
Delhi-Frome- Santos Betoota No.1 Water- supply Bore (Mt. Leonard)	?	400 yards S. of D.F.S. Betoota No.1 Bore	A.	3616, 3630	Surface	35,000	265.2 grains per gallon. 127.6gr. KCl 114.1gr. Na ₂ CO ₃ 20.0 gr. organic matter.	Mines Administration Pty. Ltd. 1959.
Leonard Bore (Mt. Leonard)	12694	10 miles S. of Betoota	S.A.	52	32	300	Bad	
Mt. Leonard 1 or Wyerie No.1 (Mt. Leonard)	13142	12 miles S.E. of Betoota	S.A.	55 218 355	? ? ?	9600 7200 1200))) Good	Cole
Mt. Leonard 2 (Mt. Leonard)	13143	9 miles S.W. of Betoota	S.A.	60 238	? ?	1440 7200)) Bad	Cole
Mt. Leonard No.3 or Wyerie Bore No.2 (Mt. Leonard)	14082	50 yards from Wyerie No.1, on the other side of the road. (Twin bores).	S.A.	As in Wyerie 1.	?	As in Wyerie 1	As in Wyerie 1	J. Titchbourne
Roseberth (Roseberth)	7192	Roseberth ("The Bluff") Homestead.	S.A.	47	?	?	Salty	D.J. Shepley 1938

BETOOTA QUEENSLAND

Figure 3.



REFERENCE

QUATERNARY	Czs	Sand and sand dunes.
	Ca	Alluvium.
	Cz	Gibber gravel, (Tm) of Marion Formation.
TERTIARY	AUSTRAL DONNS LIMESTONE	Silicified limestone as grey and black chalcidony.
	MARION FORMATION	Silicified coarse sandstone, fine sandstone and sandy siltstone.
CRETACEOUS	NINTON FORMATION	KuW Arkose and siltstone.

---	Geological boundary, position approximate.
X	Measured dip and strike.
⊕	Dome
- - -	Probable structural line.
—	Fence.
—	Road, track.
■	Town, homestead.
⊕	Aerodrome.
□	Yard.
⊕	Dry oil bore.
⊕	Artesian bore.
⊕	Sub-artesian bore.
⊕	Abandoned bore.
⊕	Well.
⊕	Tank.
⊕	Windmill.
⊕	Waterhole.
253	Surveyed height in feet.
648 312	Specimen locality.

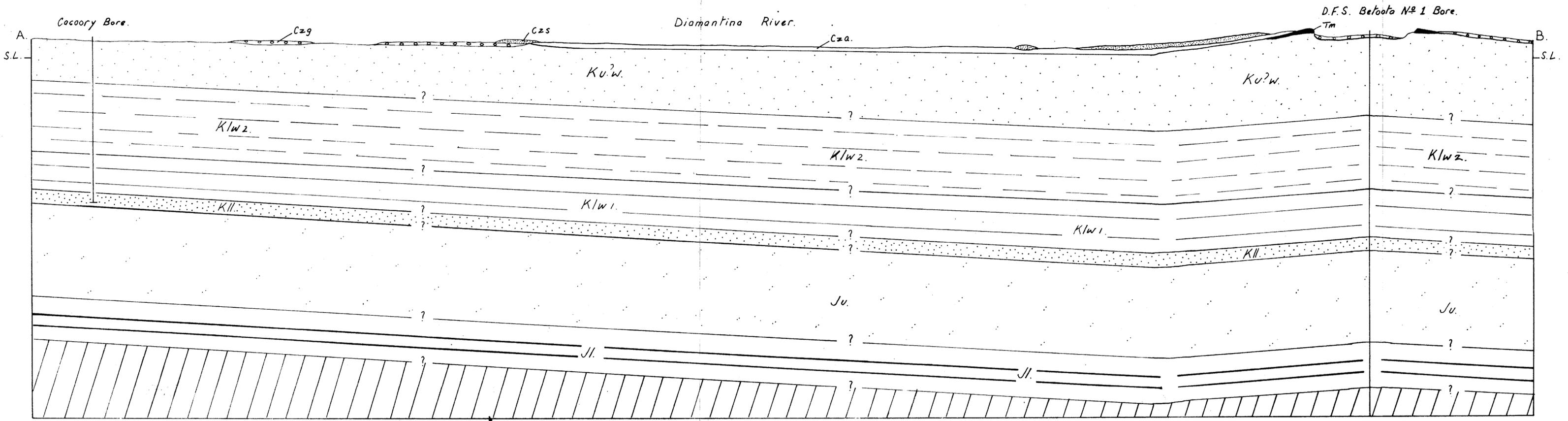
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Beloune	Machattie	Connemara
Birdsville	Beloune	Canterbury
Pandie	Cordillo	Barrokka

Reliability diagram

SCALE:
1 inch = 4 miles.

DIAGRAMMATIC SECTION THROUGH THE BETOOTA 4-MILE SHEET AREA.



Horizontal Scale - 1 inch : 4 miles. Vertical Scale - 1 inch : 1,000 feet.

REFERENCE.

	Cz9	Aeolian sand.	KII	Winton Formation.	
Quaternary.	Cza	Alluvium.	Klw2	Wilgunya Formation. 2. Upper. 1. Lower.	
CAINOZOIC.	Cz9	Gibbers.	Klw1	Lonsight Sandstone Equivalent.	PALAEOZOIC. or
Tertiary.	Tm	Marion Formation.	Ju	Blythesdale Group.	UPPER PROTEROZOIC.
			JI	Walloon Coal Measures.	Undifferentiated.
					Pz
					Steeply-dipping red-bed conglomerates.

Undifferentiated Palaeozoic or Upper Proterozoic.