COMMONWEALTH OF AUSTRALIA.

DEPARTMENT OF NATIONAL DEVELOPMENT.

BUREAU OF MINERAL RESOURCES
GEOLOGY AND GEOPHYSICS.

RECORDS.

1958/116

SUMMARY OF ACTIVITIES

SEDIMENTARY BASINS, 1958

SUMMARY OF ACTIVITIES, SEDIMENTARY BASINS, 1958

Compiled by

M. A. Condon

RECORDS 1958/116

During 1958, the Georgina Party under J. N. Casey and the Jervois Party under K. G. Smith continued the mapping of the Georgina Basin in Queensland and Northern Territory. M. A. Condon visited both parties late in the field season.

The mapping of the Glenormiston and Huckitta 4-mile sheets was completed and some mapping done on the Springvale, Mt. Whelan and Tobermory sheets (Figure 1).

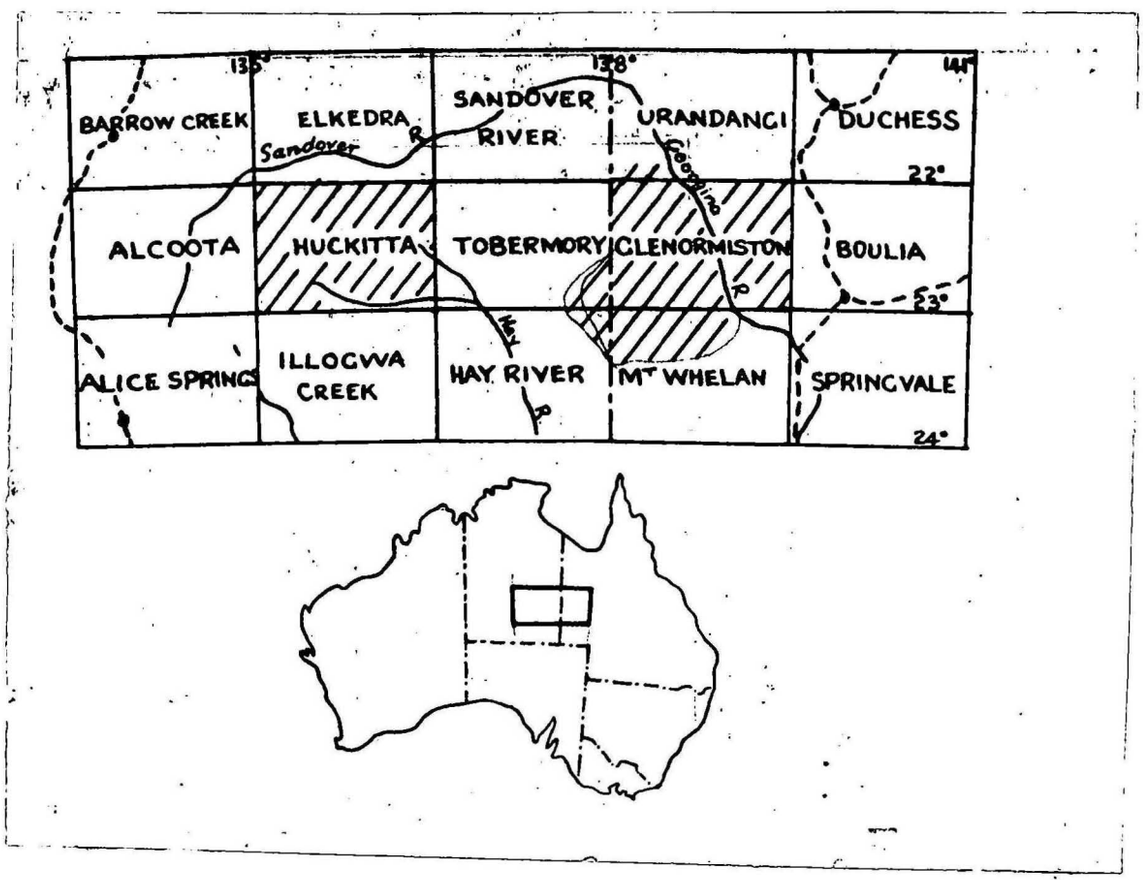

Figure 1 - Locality map showing areas mapped in 1958.

Stratigraphic drilling was undertaken in the Canning and Carnarvon Basins of Western Australia; J. M. Pulley and W. J. Perry were well-site geologists.

A summary of oil-search activities in Australia and New Guinea was checked and revised by Dr. Terpstra and published as a report.

In connection with the Petroleum Search Subsidy Act, M. A. Condon and Dr. Terpstra commented on applications for approval and checked the information submitted by the companies.

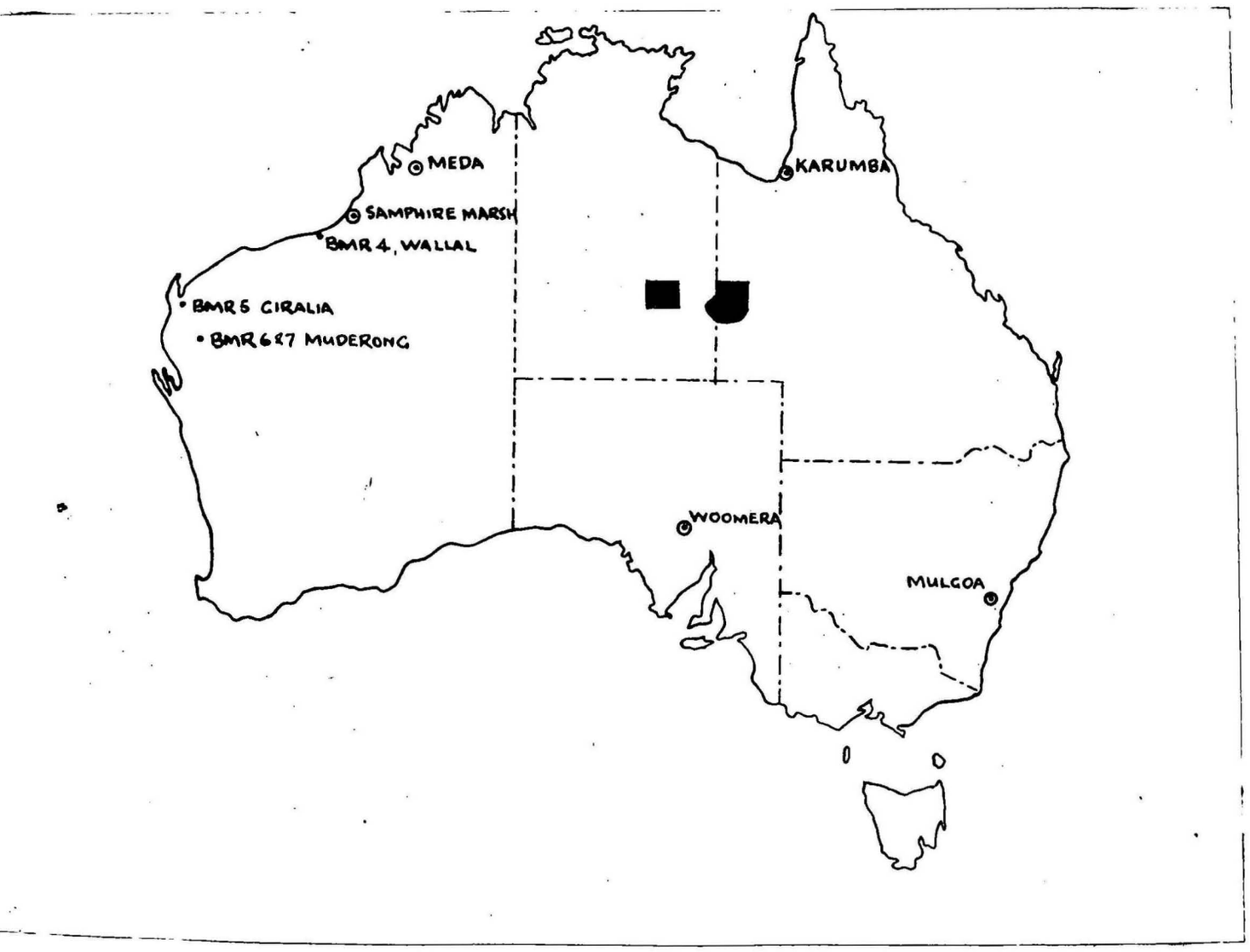

Figure 2 - Map showing areas mapped, stratigraphic bores and subsidized stratigraphic bores.

The following bores were drilled during 1958 under subsidy agreements (Figure 2): Kaufana, Papua T.D. 3380 feet (Papuan Apinaipi Petroleum Co.); Woomera, South Australia, 2005 feet (Clarence River Basin Oil Exploration N.L.); Karumba, Queensland, T.D. 2364 feet (Associated Australian Oilfields); Samphire Marsh, W.A., T.D. 6664 feet and Meda, W.A., T.D. 8809 feet (West Australian Petroleum) and Puri, Papua, T.D. 10,000 feet (Australasian Petroleum Co.). Dr. Terpstra is preparing the information from these bores for publication after a lapse of 12 months from the completion of drilling.

GEORGINA PARTY

by J. N. Casey

Introduction

The survey of the Georgina River area (which is part of the poorly defined Georgina Basin) south of the 22° latitude was re-started by the Bureau of Mineral Resources in 1957, commencing with the Boulia 4-mile sheet. It was continued in 1958 and the sheets to the west and south of Boulia, viz. Glenormiston, Mt. Whelan and Springvale, together with the eastern quarter of Tobermory and the north-eastern corner of Hay River in the N.T., were mapped in detailed reconnaissance accuracy.

The party in 1958 consisted of geologists J. N. Casey, M. A. Reynolds, P.W. Pritchard, G. Lucas and R. Paten (Queensland Geological Survey representative) together with assistants W. Brager (cook), A. White (mechanic) and B. Quinlan (field assistant). The field work extended from the 14th May to 8th October (21 weeks) and the work was undertaken from a base camp on the Georgina River, near Roxburgh Downs Homestead, 120 miles from Dajarra and an equal distance from Boulia.

The base for the regional map at 8 mile to 1 inch scale to accompany this report was taken from the Australian Aeronautical Series at 1" to 15.78 miles.

An extensive collection of rock samples and fossils was made at over 500 localities (9 x 44 gallon drums of material were brought from the field for further work and reference). Dr. Opik and Miss Tomlinson are working on the Cambrian-Ordovician fauna, the Upper Jurassic-Lower Cretaceous plants by Mrs. White, silicified wood remains by Mr. Cater (retired ex-Forestry School, Canberra) and the Lower Cretaceous micro-fossils by Miss Crespin.

Visits were made to the party by Dr. Fisher, Mr. Condon and Dr. Opik, of the Bureau of Mineral Resources, as well as by Mr. Allen from the Queensland Geological Survey and Mr. Laing from Mines Administration, the consulting company to Papuan Apanaipi Petroleum who have recently taken out an Authority to Prospect for Petroleum over the area dealt with in this report.

Gravity traverses were run by Mr. Van Son of the Bureau of Mineral Resources in 1957 and further reconnaissance traverses and more detailed traverses in the Black Mountain area were continued in 1958; the levelling for this work was done by Department of Interior surveyors under Mr. W. Kennedy. Some traverses were made across the area by the B.M.R. airborne scintollometer party in 1958 during reconnaissance flights across the Great Artesian Basin.

Frome Broken Hill Co. operated a party under Mr. R. B. Leslie in the Boulia-Glenormiston-Toko Range area in 1958.

Barometric traverses were run throughout most of the area; surveyed gravity stations provided accurate height control for this work; the order of accuracy expected from the barometric work is ±20 feet. The logs from about 400 water bores were collected and in most cases the height of each bore was determined by barometer.

The total cost of the field part of the 1958 survey (excluding geologists salaries) is £6,000, made up of the following:

Wages £3000; fares £200; consumable stores and write-offs £400; petrol and vehicle spares £1100; vehicle hire from 1/5/58 to 22/10/58 £1300 (at £6/10/- per week per Landrover, £9/10/- per International 4x4 truck, £1 per water trailer, 5/- per trailer). Each landrover covered nearly 9,000 miles during the time away from Department of Supply, Brisbane. A total of 57 drums of fuel was used during field operations, excluding the fuel used in travelling to and from the field.

Geology

Field mapping 1958 was concentrated first on the Glenormiston 4-mile sheet; the Toko Range, where the best exposures of the Ordovician sequence occur, occupies the western edge of the Glenormiston sheet and in order to map the Toko Range as a unit, the field work was extended onto the Tobermory and Hay River sheet edges where better outcrops of the Ordovician succession were exposed. Mapping was extended south to include part of the Mt. Whelan sheet, which is largely covered by gibber plains overlying Lower Cretaceous claystone in the eastern part, and several traverses were made through the Springvale sheet. One traverse was made from Marion Downs to Bedourie and north along the Mulligan River. Other traverses were made into the south-west corner of the Urandangi sheet.

Very little detailed work was done on Precambrian outcrops in the north-east part of Glenormiston sheet as this had previously been mapped by E. K. Carter of this Bureau.

The stratigraphy is outlined in Table I.

Results

A summary of the more important results of the 1958 survey may be listed as follows:

1. A large thickness (about 2,000 ft.) of interbedded green mudstones and boulder beds in the Field River-Craigie Dam area (N.T.); the boulder beds contain many striated, faceted, chatter-marked boulders, foreign to the area and which give the deposit a possible glacial origin. No moraines or pavements have been found but the green mudstones show a repetition of fine graded bedding which is very similar to varves. Age is probably Upper Proterozoic.

2. An area of probably Lower Cambrian arkose, arkosic sandstone, dolomitic sandstone, dolomite lenses, fine conglomerate, greywacke sandstone, shales and silicified sandstone was mapped as an inlier in Lower Cretaceous sediments in the Sylvester Creek area, Marion Downs. About 250 ft. of section is exposed. Tracks and trails in the beds indicate Lower Cambrian age. The interbedded greenish shale gives a radioactive count of 2-3 times background; similar beds occur at Sun Hill and in the Black Stump area, Northern Territory.

3. The arkosic beds are cut by quartz veins in which occur lead crystals and copper staining; the arkose has traces of iron, copper, lead, and perhaps nickel under X-ray examination. One shaft 6' x 6' x 20' has followed down the

quartz veins but it has not been worked since the early 1900's - it was reported locally that gold was won from the veins in the early days. The quartz veins occur in the southern part of the arkose outcrop, north of Watchee Hut, Sylvester Creek area, and they trend generally east-west.

4. Lower Cambrian arkose, greywacke, conglomerate are found overlying and flanking the Precambrian on north-eastern part of Glenormiston Sheet.

5. Lower middle Cambrian bedded chert containing Redlichia also overlies Precambrian on north-eastern part of Glenormiston sheet.

6. Further outcrops of Middle and Upper Cambrian limestones (representing Devoncourt Limestone and Georgina Limestone) were mapped east of Mt. Whelan; only about 150 ft. of thickness is visible and the limestones strike north-south and dip west; it is the most southerly occurrence of Cambrian limestones in the Georgina area so far known in outcrop.

7. It was shown that the large area of Georgina Limestone exposed south of Glenormiston station and of slightly older limestones in the Mungerebar area, represented only about 150 feet of section in each area.

8. The Lower Ordovician Ninmaroo Formation of limestone, dolomite and interbedded sandstone transgresses the Cambrian units and is probably unconformable on them.

9. About 1200 ft. of Middle Ordovician sediments (predominently sandstones, siltstones with some limestone, dolomite, coquinite and chert beds) has been mapped in six units in the Toko Range.

10. A thickness of about 150 ft. of medium-grained sandstone with some clay pellets and fine conglomerate lenses overlies the highest of the fossiliferous Ordovician units, and appears to be overlain by Mesozoic (probably Lower Cretaceous) sandstone and siltstone beds with wood remains. This unit, mapped as Ordovician undifferentiated, maybe part of the Ordovician succession, may represent the base of the Mesozoic or may be an intervening unit, age not known. The beds dip low to S, SE or SW but have belts with dips up to 40°.

11. A relatively flat area 40 ft. x 20 ft. was found exposed in a gully off the west side of Sylvester Creek; it showed features such as parallel fluting and parallel crescent "dishes" attributed to ice action although no striations were seen. The "pavement" was formed on probable Lower Cambrian silicified sandstone.

12. In several areas, e.g. south of Mithaka WH., west of Roxburgh Down Homestead (Blue Mountain), west of the southern part of the Tooma Range, in hills near Burnt Well, overlying arkose at Sun Hill, and overlying the Lower Cambrian sandstone near Sylvester Creek, were found boulder beds, conglomerate and sandstone; the youngest unit these beds overlie is Ordovician and they are overlain by Lower Cretaceous Wilgunga Formation of blue clays. The boulders have striations, some are facetted and some are boulders 4 ft. in diameter which are foreign to the area. The sandstone contains fossil wood of the conifer type. It is

possible this unit has a fluvioglacial origin, in which case it is assumed to be Permian in age; the presence of a "pavement" mentioned in (11) enhances this origin; but the presence of the boulders always unconformably overlying or against the older units, with Lower Cretaceous clays overlying the boulders in the Sylvester Creek area, makes the possibility of the boulders being a basal Cretaceous conglomerate not out of the question.

13. The springs near Mt. Whelan and Carlo, and south along the Mulligan River issue through Lower Cretaceous blue clays (Wilgunya Formation) where this formation abuts against or covers marginal highs of the Lower Palaeozoic rocks.

14. The Toolebuc limestone Member of the Lower Cretaceous Wilgunya Formation persists through the Boulia Sheet to the Springvale and Mt. Whelan areas; it parallels the Hamilton River to Hilary Tank and similar fossils occur near No. 6 bore, Springvale. The fossil assemblage of ammonites with Inoceramus and foraminifera Globigerina is characteristic.

15. The Tertiary spring deposits near Springvale Homestead contain ostracods and gastropods in the chert beds which overlie a red sinter, silicified limestone sequence.

16. Most of the east and central part of Mt. Whelan sheet is covered by "gibbers" which mainly consist of silicified silty sandstone from the Tertiary Marion Sandstone [illegible]; in contrast, the plains on the south part of Springvale Sheet are smooth ("prairies") with a surface of ferruginised or silicified siltstone from the Lower Cretaceous units.

17. The "blue clays" of the Wilgunya Formation grade upwards to white silicified siltstone which forms hills; the gradation is continuous and the two different topographic and lithologic units are one and the same formation.

18. A structure trending 120° near Sun Hill is an asymetrical fold with a probable concealed fault. It separates the Cambrian limestone and Ordovician dolomite in this area and the structure may persist along Pituri Creek to the north-west.

19. The Toko Range, although it is cut by NNE trending faults and fold axes, is an asymetrical syncline trending SSE and pitching to the south.

20. Compression from the E to the W has crumpled the Toko succession against Upper Precambrian rocks on the west (M.T.) side, resulting in a belt with intense folding and faulting (including strike faulting) along this western edge, and to the east the deformation becomes less pronounced.

21. The outcrops south of Springvale H.S. on the apparent continuation of the Black Mountain structural line is not Lower Palaeozoic (as thought from photo-interpretation) but is Tertiary (with ostracods) and Cretaceous.

22. Shallow ill-defined structures (synclinal and anticlinal) exist in the bituminous Upper Cambrian Georgina Limestone, near Glenormiston Homestead.

23. It was seen that leaching and induration of limestones-dolomites produces a similar rock to a "siltstone" which can be most confusing when working with deeply weathered outcrops.

24. One deposit at least of possible "pipe clay" was found near the Keysers Group of hills, N.T. It may not be of commercial significance because of location but it is academically and geologically important. It is overlain by Mesozoic sandstone and overlies Upper Proterozoic green mudstones of the boulder bed-mudstone sequence.

JERVOIS RANGE PARTY

by K. G. Smith

General

The party consisted of K. G. Smith, K. Gough, R. R. Vine, D. R. Woolley and W. A. Robertson.

Visitors to the party were: E. K. Carter (20/5/58-3/6/58), Dr. N. H. Fisher (17/6/58-21/6/58), Dr. A. A. Opik (11/8/58-17/8/58), and M. A. Condon (6/9/58-21/9/58), and B. Hopkins (B.H.P.), (10/9/58-13/9/58), A. Blatchford (Clutha Development), (3/10/58-9/10/58).

Field work comprised:

(1) Regional mapping of the Huckitta four-mile area.
(2) Detailed mapping of the Jervois copper mines at 40 feet to 1 inch and mapping of the area surrounding these mines, at 1000 feet to 1 inch (reported in Records 1958/).

Regional Mapping

The mapping of the Huckitta four-mile was completed. The following new information was obtained:

Archaeozoic rocks and younger intrusives

(a) At least three formations were recognised in the Arunta Complex; large expanses of alluvium prevented their linkage with formations mapped (G. F. Joklik, 1959-1951) in the Harts Range but it is believed that the Brady, Irindina and Cadney Gneisses are present on the Huckitta four-mile sheet.

(b) b-axis lineation is prominent on limbs of folds in the Cadney Gneiss. In one locality this b-axis lineation was itself gently folded; the axes of this later folding trend about 360 degrees.

(c) A large area of granite formed by metamorphism of (?)Brady Gneiss was mapped between Mt. Swan and Macdonald Downs Stations. In 1957 the Party collected a sample of this granite for age determinations (Sample No. F/53/11/3).

(d) Mica-bearing pegmatites were mapped throughout the areas where the Brady and Irindina Gneisses crop out, and in areas where the formations are indefinite. In areas occupied by definite Cadney Gneiss, no pegmatites were recorded.

(e) A few large quartz cores of zoned pegmatites were mapped. The largest of these is probably a fissure-vein type and is about 1,000 feet long, with a width ranging from 8 feet to about 30 feet.

(f) On 3/10/58, a count was taken of the miners engaged on the Plenty River mica field. On that date there were nine

Italian miners, working in three groups, and one Australian miner who was working part-time in a fourth locality.

Upper Proterozoic and Palaeozoic Sediments

(a) Numerous sections were measured in the Oorabra, Grants Bluff and Mt. Baldwin Formations, to complete the record of thickness and variations of these formations. An excellent sequence of glacial sediments was mapped and measured at Mt. Cornish. An important variation was established in the Mt. Baldwin Formation. (This is discussed in (d)).

(b) An examination was made of a locality, north-west of Oorabra Rock holes, where C. T. Madigan (1931) recorded fragmentary Archaeocyathinae. At this locality, Archaeocyathinae were located by the field party, and these fossils were confirmed later by Dr. A. A. Opik.

(c) Archaeocyathinae and brachiopods were located in the Mt. Baldwin Formation, in the West Jervois Range. These fossils are on the same stratigraphic horizon as others (not yet determined) discovered at a nearby locality in 1957.

(d) An examination of the Mt. Baldwin Formation showed that the arenites of the top 400 feet (approximate) of the formation change to carbonate rocks in many localities. From five localities between Oorabra Rock holes and Mt. Ultim, Archaeocyathinae and branchiopods were located a few feet above the local top of the chocolate-coloured arenites of the Formation. In these localities the sequence from the top of the last arenite to within about 200 feet of the base of the Lower Ordovician is at least 80% carbonate rock. This carbonate sequence contains a considerable thickness of oolitic beds.

(e) The main carbonate sequence is succeeded by a formation which is dominantly arenaceous and whose age ranges from Upper Cambrian to Ordovician. The formation contains numerous units of green siltstone, but none of these units has a recorded thickness of more than three feet.

(f) The Cambro-Ordovician arenite sequence is succeeded by an Ordovician sequence which has a different lithology (dolomite, quartz greywacke, ferruginous oolite, green mudstone, green siltstone) in the area of Jinka Spring-Picton Spring. To the north-west of the area, equivalent beds are of the same lithology as the arenaceous Cambro-Ordovician sequence, and the separation of the formations listed in (e) and (f) is a difficult matter.

(g) A regional unconformity has been established at the junction of the fossiliferous Ordovician sediments and the Dulcie Sandstone. At a location eight miles south-east of Huckitta homestead, fossils were collected from the Dulcie Sandstone. These have subsequently been examined in Canberra by Dr. A. A. Opik, who has stated that they are Placoderms, probably of Upper Devonian age. Arrangements are in hand to forward the specimens to a specialist in this field.

(h) The full sedimentary sequence of the Huckitta four-mile is as follows. (Time rock units are approximate and may be revised slightly when fossil collections are studied).

Quaternary	Soil, sand. The depth of soil cover is considerable, and much of it is probably transported soil.		
Tertiary	Limestone	35 feet	
?Permian	Silty sandstone with angular blocks of quartz sandstone.	150 feet (est.)	One outcrop only
?Devonian	Dulcie Sandstone	2100 feet	
	--------Unconformity--------		
Ordovician	Dolomite, quartz greywacke green mudstones, oolitic iron beds.	450 feet	Richly fossiliferous.
Cambro-Ordovician	Arenite, limestone, siltstone.	500 feet	Richly fossiliferous.
Upper Cambrian	Carbonate sequence.	1000 feet	Oolitic in part.
Middle Cambrian	Shale, limestone, sandstone.	500 feet (est.)	Richly fossiliferous.
?Lower Cambrian	Mt. Baldwin Formation.	1200 feet	Full sequence, of arenites, siltstones thin dolomite.
?Upper Proterozoic	Grant's Bluff Formation.	850 feet	
?Upper Proterozoic	Oorabra Formation	150 feet.	
	--------Unconformity--------		
Upper Proterozoic	Tillitic and varved sediments	600 feet+	
	--------Unconformity--------		
?Archaean	Granite and metamorphics.		

The important part of this sequence, as regards oil search, is thus of the order of 5,000 feet thick. Considerable variations of this thickness occur, and an additional 2,000 feet occurs in some localities; but this addition is mainly from the Oorabra and Grant's Bluff Formations. In some localities the thickness is reduced by as much as 700 feet because of erosion of Ordovician sediments.

WATER BORES

Several new bores, both Government and private, were drilled in 1958. Information regarding these was collected and passed to the Resident Geologist, Alice Springs Some features of interest were:

(i) The depth of soil - 202 feet plus, and 158 feet, both on the banks of the Marshall River.

(ii) The recording, from a depth of 150 feet of ferruginous limestone similar to that seen on the surface and regarded as a result of lateritic processes. In the same bore, chert was recorded at 190 feet; this chert is similar to much of the surface material of the surrounding area.

AERIAL RECONNAISSANCE

M. A. Condon, T. Quinlan and K. G. Smith conducted an aerial reconnaissance of the northern and eastern portions of the Frew River four-mile sheet on 6th and 7th September, 1958. Two flights were made from Hatches Creek; the primary object was to search for Cambrian and Precambrian rocks in semi-desert areas. Numerous small outcrops, probably of Cambrian age, were located and a few outcrops of Precambrian sandstone were observed. The most easterly of these was approximately 35 miles east of the eastern edge of the Davenport Ranges.

On the flight from Alice Springs to Hatches Creek, M. A. Condon and T. Quinlan made observations on the Barrow Creek and Elkedra four-mile sheets. On the return flight to Alice Springs, T. Quinlan made observations on the Dulcie Sandstone, in an attempt to locate an unconformity at the base of this unit. Quinlan's effort was unsuccessful.

Total flying time was nine hours, which cost £135.

STRATIGRAPHIC DRILLING

by J. M. Pulley and W. J. Perry

A programme of shallow stratigraphic drilling in Western Australia was undertaken during this year. A total of 5 bores at 3 localities were drilled under contract by Oil Drilling and Exploration Ltd. with the Bureau's Failing type 2500 rig. The locations and objectives of the bores are summarised below:

Bore	Locality	Objectives
BMR4 and 4A	Wallal Downs, Canning Basin.	Information about the structure of a basement high and the stratigraphy of the overlying sediments. Verification of seismic indications of a possible subsurface Palaeozoic calcareous sequence was of great importance in relation to the oil potentialities of the basin.

BMR5	Giralia, Carnarvon Basin	Seismic surveys indicated a probable increase in thickness of over 1,000 ft. of the Mesozoic sediments below the Upper Cretaceous outcrops on the Giralia anticline. This section contains the beds in which oil was found a few miles west in Rough Range anticline.
BMR6 and 7	Muderong, Carnarvon Basin	To provide information on the nature of the structural-stratigraphic discontinuities in the Carnarvon Basin, in particular, information was sought on the nature of the contact exposed at the south-west of "Big Hill", about 1 mile west of Muderong Bore.

A programme of 10 ft. coring every 100 ft. was approved. Ditch samples were collected at 5 ft. intervals.

Resume of Activities

Field activities began at the end of February when a party consisting of M. A. Condon, C. Breaks (Drilling Superintendent), J. M. Pulley and representatives of Oil Drilling and Exploration Ltd., inspected and fixed the bore sites. J. Pulley spent the following month on Samphire Marsh No. 1 Well which was then being drilled by West Australian Petroleum Pty. Ltd. at a site about 40 miles east-north-east of Wallal. Experience in the organization of well-site work was obtained. BMR4 was spudded on the 1st April and drilled to 1410 ft. on 12th. Premature abandonment at this depth resulted from the breakthrough of a strong artesian flow while the rig motors were out of action. After several unsuccessful attempts to mud-off the water, the well was temporarily abandoned pending the arrival of casing and mud supplies.

A second hole, BMR4A, was spudded 90 yards west of BMR4 on 22nd April, and on penetration of basement, was completed as a water well for the station at a total depth of 2228 ft. a fortnight later. The upper part of the bore was "E" logged with a BMR "Widco" single electrode logger. West Australian Petroleum Pty. Ltd. provided a Schlumberger oil-field unit for the bottom-hole log.

Plugging operations on BMR4 were then resumed. Because of washing out of the walls in the interim, and the presence of lost-circulation zones above the water sand, the task of mudding-off the water and setting a plug above was not completed until 7th June.

BMR5 was spudded on 26th June and had been drilled to 96 ft. when drilling operations were suspended because of continued mechanical trouble. After overhaul of the rig motors in Perth, drilling was resumed a fortnight later. The bore was completed at T.D. 2070 ft. at end of July without further major interruption. Electric and radioactivity logs were recorded.

Geology

BMR4 and 4A, Wallal

Objective: Because of masking by sand and inaccessibility, little is known about the geology of the southern Canning Basin. Recent geophysical investigations revealed thinning of the sedimentary cover over several west-north-west trending basement highs. One of these intersects the coast near Wallal, where the surveys recorded probably basement velocities at a depth of 2,000-3,000 ft.

Thus, with a shallow bore, the stratigraphy of the sedimentary cover could be determined. Apart from the value of this information as a whole in the search for oil, if the presence of a calcareous Palaeozoic sequence suggested by refractor velocities was confirmed, this part of the basin would become a target for detailed investigation. Furthermore, evidence of the origin and history of the basement structure could be expected, especially after Wapet's decision to drill a deep bore on the northern side of this feature, where basement is at a depth of over 6,000 ft.

Results: The stratigraphy of the section penetrated is set out in Table 2. Correlations have been attempted with formations outcropping in the northern part of the basin and encountered in Roebuck Bay and Samphire Marsh bores. The Jurassic sandstones are artesian. No signs of oil or petroliferous gas were detected.

Comparison with the section at Samphire Marsh shows that the reduced thickness is accounted for almost entirely by thinning of the Palaeozoic sediments, but that flexure or faulting occurred during the Mesozoic.

BMR5, Giralia

Objective: Seismic profiles (Chamberlain, 1954) across the northern end of the Giralia Anticline (Condon et al. 1956) show a marked unconformity about 2,700 ft. below the outcrops of Upper Cretaceous limestone on the crest of the fold. The beds below this unconformity are synclinally folded along an axis parallel to that of the anticline. If the assumption - supported by refraction velocities - that this surface marks the top of the Permian sequence is correct, the overlying Mesozoic section is more than 1,000 ft. thicker than in nearby areas of outcrops and bores. Since this includes the Birdrong Formation in which oil was discovered a few miles west as well as source rocks the nature of the additional section was of great economic interest.

Results: The formations encountered are shown in Table 3. The following conclusions are significant:

1. The Mesozoic sediments are thicker than outcrop on Giralia Anticline but thinner than in Rough Range (McWhae et al. 1958, p.112).

2. The Jurassic section encountered at depth on the western side of Exmouth Gulf may persist eastwards, although with greatly reduced thickness. Up to 115 ft. of carbonaceous shale, siltstone and very fine-grained quartz greywacke underlying the Birdrong Formation may be a finer-grained

facies of the Learmonth Formation (McWhae et al., 1958, p.91).

3. The Permian siltstone and very fine grained sandstone is of similar lithology and age to the uppermost Permian sediments in Giralia No. 1, 23 miles south-south-west along the anticlinal axis.

4. The major unconformity is probably present within the Permian system and not between Permian and Mesozoic as had been expected.

BMR6 and 7, Muderong, Carnarvon Basin

Purpose: The bores at Muderong were intended to provide information on the nature of the structural-stratigraphic discontinuities in the Carnarvon Basin; in particular, information was sought on the nature of the contact exposed at the south-west of "Big Hill", about 1 mile west of Muderong Bore.

Programme: The original programme called for three shallow bores 800 to 900 feet apart in an east-west line some 2 miles west of north of Muderong Tank; the westernmost bore a. 750 ft. deep) to be about 500 feet east of the inferred position of the contact which was thought to dip east at a maximum dip of 30°. Bore b. was to be 850 feet east of bore a. and 1,000 feet deep and bore c. 850 feet east of b. and 1250 feet deep. Ten feet of coring was required in each 100 feet drilled and cuttings were sampled every 5 feet.

Results: Mr. S. P. Wilmot of Wapet was well-site geologist during the drilling of BMR6 and W.J. Perry was well-site geologist on BMR7.

The contractors spudded the central bore (BMR6) first on 10th August, 1958. This was completed at 1,002 ft. on 19th August. A core taken at 295-305 feet showed dips of 30°; cores at 100 feet intervals above and below this showed flat dips. The projection of the inferred contact at a 30° dip intersected the surface east of the westernmost bore, consequently this was not drilled and the available footage remaining in the contract (2,000 feet) was used in the easternmost bore (BMR7), which was completed on 14th September.

Correlation of the bores is difficult probably because of the lack of good marker beds and the general similarity of one formation to another within the Byro Group. A probable correlation using lithology and E logs is shown in the attached table. As the core dips in both bores are near flat with the exception of core 4 in BMR6, a normal fault between the bores is postulated, trending approximately north with the downthrown block on the east side.

Notes on Drilling Bores for Structural Information

Core recoveries obtained in BMR6 and 7 ranged from 0 to 100% but averaged only about 55%. Better recoveries than these are necessary in holes drilled for structural information, for it is often the case that core is lost at critical intervals.

If available for the Failing rig, a split inner core barrel should be used.

REPORT AND MAP COMPILATION.

CANNING BASIN: A. T. Wells and J. J. Veevers continued with the compilation of maps and reports covering the Canning Basin. In the course of this work a structure visited in 1956 was re-interpreted as a probable salt dome, affecting Permian and Cretaceous sediments and exposing a core of dolomite and gypsum. A report on this feature has been prepared for publication.

The Tabletop, Paterson Range and Yarrie 4-mile sheets were revised and prepared for publication and the sheet notes drafted.

The Billiluna and Mt. Bannerman sheets and notes were completed ready for fair drawing.

Photo-interpretation on the Runton sheet was completed.

A regional geological map of the north-eastern Canning Basin was compiled and the report submitted for editing.

CARNARVON BASIN: The Kennedy Range 4-mile sheet and notes was completed by M. A. Condon in draft ready for fair drawing.

Condon compiled the areal geology on the Glenburg four-mile sheet and continued the draft of the Bulletin on the Carnarvon Basin.

M. C. Konecki, J. M. Dickins and T. Quinlan completed the report on the area between Gascoyne and Murchison Rivers. It is now in press.

AMADEUS BASIN: C. E. Prichard and T. Quinlan made some progress on the draft of the report on the 1956 work in the Amadeus Basin but it is not completed.

BOULIA AREA: J. N. Casey, M. A. Reynolds, D. B. Dow, P. W. Pritchard, R.R. Vine and D. Paton completed the first draft of a report on the Boulia area and of the Boulia 4-mile sheet. Some revision was required and this is being done.

GENERAL: Dr. Terpstra completed the checking and revision of the summary of oil search activities in Australia and New Guinea that was published late in the year.

He compiled a map of bores for oil, for the Australian Resources Atlas.

REFERENCES

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TABLE 1 : STRATIGRAPHY OF THE GEORGINA RIVER AREA - GLENORMISTON, MT. WHELAN, TOBERMORY SHEETS

AGE	FORMATION	THICKNESS	AREA OF OUTCROP	TOPOGRAPHY	LITHOLOGY	STRUCTURAL RELATIONSHIPS	FOSSILS
QUATERNARY	(Soil) Cz (Sand)	Up to 30'	Simpson Desert, major rivers.	Plains.	Red-brown and grey soils White and red-brown quartz sandstone.		
TERTIARY	"Springvale Sinter" Tv	40'	Near and south of Springvale Homestead.	Dissected mesas and breakaways.	Chalcedony, red & brown sinter, chert and fine sandstone. Siliceous limestone.	Overlies Lower Cretaceous; top eroded and lateritized.	Ostracods, gastropods.
	"Mt. Cooley Beds" Tc	45'	Mt. Cooley, Mt. Whelan, Sugarloaf Hill and as chalcedony scree on parts of Marion Downs.	Cappings on hills and some as scree.	Chalcedony, red sinter, limestone.	Overlies leached and lateritized Lower Cretaceous; top eroded.	None found.
	Austral Downs Limestone Ta	0-45'	Along Georgina River, Pituri Creek and north of Aroota Bore.	Scarps fromed by stream dissection; buttes and mesas.	Chalcedony, limestone, red pisolitic limestone.	Unconformably overlies Ninmaroo Formation and other formations.	None found.
	"Marion Formation" Tm	0-30'	West of Marion Downs H.S. and south towards Bedourie.	Forms much of the gibber plains and as cappings on hills.	Silty sandstone, sandstone, fine conglomerate; very silicified "billy".	Overlies leached and indurated Wilgunya Formation. Top eroded.	None in this area; wood in Boulia area.
MESOZOIC	"Wilgunya Formation" Klw	0-1100'	Springvale, Marion Downs, Mt. Whelan, Carlo Spring area, Godfreys Tanks and area in a N-S belt north of Herbert Downs to Precambrian.	Plains, usually gibber covered, and as leached flat-topped hills.	Claystone, siltstone, sandy siltstone, radiolarian siltstone.	Overlies sandy aquifer in Great Artesian Basin.	Foraminifera, some radiolaria, some macrofossils including Inoceramus and ammonites.
	"Toolebuc Member" Klwt	0-50	In a belt parallel to but east of the Hamilton River, to Hilary Tank on Marion Downs.	Low rises and concretion strewn plains.	Calcareous siltstone, sandy limestone, concretionary.	A member in Wilgunya Formation.	Radiolaria, forams including Globigerina, macrofossils include Inoceramus & ammonites.
	"Longsight Siltstone" Kll	0-150'	In subsurface under Great Artesian Basin; west of Buckingham Downs forms divide extending from Precambrian in north to Herbert Downs in south, and south of Sun Hill.	Base of hills and plateaux, and as low hills.	Sandstone, sandy siltstone, conglomerate.	Conformably under Wilgunya Formation and overlies Precambrian, Cambrian and Ninmaroo Formation unconformably.	Forams, macrofossils include Fissilunula; basal beds contain plant remains.
	Mesozoic Undifferentiated Ms	100'	Ten Mile Hills, Mt.Idamea, west of Alcoora Spring, north and south of Burnt Well, south of Mithaka W.H.	Low hills and dissected plateaux.	Sandstone, silty sandstone; often silicified and ferruginized.	Unconformably on Lower Palaeozoic units.	Wood remains, worm burrows.
PERMIAN	Permian Undifferentiated P	40'	North of Burnt Well, northwest of Ten Mile Hills, south-south-east of Mithaka W.H., south-south-east of Cravens Peak, near Sun Hill, near Sylvester Creek north of Natchee.	Low hills and rises and boulder residuals.	Sandstone with boulders, silty sandstone, conglomerate and coarse boulders.	Overlies Ordovician with unconformity; possibly overlain by Lower Cretaceous Longsight Sandstone near Sun Hill.	Fossil wood.

AGE	FORMATION*	THICKNESS	AREA OF OUTCROP	TOPOGRAPHY	LITHOLOGY	STRUCTURAL RELATIONSHIPS	FOSSILS
ORDOVICIAN	Ordovician Undifferentiated O	150'	East of the Toomba Range and north of Two Hills; south of Cravens Peak dud bore beyond the first sandstone scarp.	Low hills, rises and strike ridges.	Sandstone, some conglomeratic; clay pellets.	Overlies Mithaka Formation; probably overlain by Lower Cretaceous, definitely by Mesozoic Undifferentiated.	None found.
	"Mithaka Formation" Omm	100'+	Toko Range, south of Mithaka W.H. and north and south of Craven Peak dud bore.	Buttes, strike ridges and valleys.	Brown gypsiferous siltstone and sandstone.	Conformable with Toko Sandstone.	Pelecypods, brachiopods, trilobites, sponges, nautiloids, Recapelaculites, tracks and trails.
	Toko Sandstone Omt	150'+	Forms top only of Toko Range scarp and extends into the centre of the range.	Toko Range and isolated mesas.	Red and brown thick bedded sandstone with clay pellets and some siltstone.	Conformable with Nora Formation.	Rare but some pelecypods, tracks and trails and trilobites.
	"Nora Formation" Omn	200'	Forms scarp of Toko Range and the plains adjacent to the range.	Base and slope of range, on plains and low hills.	Olive, yellow and grey siltstone, fine grained sandstone, coquinite lenses up to 50 ft. thick.	Conformable with the Coolibah Formation.	Pelecypods, brachiopods, nautiloids, trilobites, bryozoan gastropods, tracks and trails.
	"Coolibah Formation" Omc	250'	Follows edge of Toko Range.	Low hills and strike ridges round the range.	Grey and white limestone, sandy limestone and dolomite with chert leases ("buck quartz").	Maybe unconformable on Kelly Creek Formation.	Nautiloids, gastropods, corals , sponges, ribeirioids.
	"Kelly Creek Formation" Olk	250'	Parallel to scarp of Toko Range.	Buttes and strike ridges.	Sandstone and siltstone with chert lenses and silicified coquinites.	Conformable on the Ninmaroo Formation.	Nautiloids, brachiopods, trilotibes, ribeirioids.
	Ninmaroo Formation Oln	1200' ±	Dinner Creek (Jobermory), parallel to and on W. side of Toomba Range, from Toko Ra. to Georgina River and Urandangi; to Glenormiston and Herbert Downs, and Roxburgh Downs.	Plains, low rises and terraced hills (Bannockburn Hills)	Limestone and dolomite, some places sandy with sandstone interbeds and algal beds, intraformational breccia and oolites.	Probably unconformable on Georgina Limestone and the older Cambrian units.	Algae (stromatoliths), nautiloids, brachiopods, ribeirioids ("keyhole") and "mandibles".
	Georgina Limestone €ug	100' ±	Between Glenormiston and 20 mile Bore, Tysons Bore to Sun Hill, and East of Mt. Whelan.	Plains.	Blue and grey calcarenite, calcilutite, bituminous sandy beds, some intraformational breccia and chert biscuits.	Probably separated from older Cambrian units by non-deposition rather than angular unconformity.	Trilobites (agnostids, etc.), brachiopods, hyolithids.
	Steamboat Sandstone €ms and Transition Beds €m/€u	400'±	In Mungerebar, Smokey Creek area.	Plains and dissected hills.	Calcilutite, calcarenite with chert biscuits, sandy calcarenite and calcareous sandstone and siltstone, and sandstone	Transition beds predominantly carbonates maybe partly equivalent to Georgina Limestone.	Trilobites, brachiopods.
	Devoncourt Limestone €md	50'-	North of Craigies Dam, west of Mt. Whelan and north west of Mt. Cooley.	PPlains and low strike ridges.	Calcarenite and calcilutite, bituminous and sandy.	Unconformably on lower Cambrian.	Trilobites and brachiopods.
	Thorntonia Limestone	10'; -±	Headwaters of 17 Mile Ck., near Precambrian southeast of Ardmore.	Top of mesas, and around edge of Precambrian in N.E. of Glenormiston Sheet.	Bedded chert, black and white siliceous shale, "siltstone" and dolomite.	Disconformably over Mt. Burnie Beds.	Redlichia, brachiopods.

AGE	FORMATION*	THICKNESS	AREA OF OUTCROP	TOPOGRAPHY	LITHOLOGY	STRUCTURAL RELATIONSHIPS	FOSSILS
	"Sylvester Sandstone" €ls	1200' ±	Sylvester Creek on Marion Downs.	Hills.	Silicified sandstone, green shale.	Probably conformably on Sun Hill Beds.	None.
	"Sun Hill Beds" Buh/€lb Mt. Birnie Beds	25' ±	Head of 17 Mile Creek, between Palaeozoic and Precambrian; Sylvester area, Sun Hill, Black Stump Dam, Cravens Peak.	Base of hills, low rises and "tors".	Arkose, arkosic sandstone, greywacke, greywacke siltstone, conglomerate, dolomitic conglomerate.	Unconformable over Precambrian and probably unconformable over boulder bed sequence.	Tracks and trails.
	"Field River Beds" Buf	2000' ±	Craigies Dam, Yardida bore, Aroota Bore.	Low hills and boulder-strewn plains.	Boulders beds (aqueo-glacial) green mudstones.	Unconformable over granite.	None (includes boulders of algal dolomite).
PRE-CAMBRIAN	Precambrian Undifferentiated.	-	North-east corner Glenormiston sheet.	Hills and ranges.	Granite, gneiss, metamorphics, quartz blows.	-	-

* Formation names in inverted commas are unpublished.

TABLE 2.

BMR4 and 4A : Stratigraphic Summary

Age	Lithology	Depth (R.T.)	Thickness	Formation
Recent	(Dune sand, calcareous clay	-	30'	
	(Calcareous clay	30'	15'	
Pleistocene-Recent	Coquinoid calcarenite	45'	33'	
Lower Cretaceous	Fine to coarse quartz greywacke and conglomerate with siltstone.	78'	267'	Broome Sandstone
Upper Jurassic	Sandy siltstone and subordinate silty sandstone.	345'	570'	Jarlemai Siltstone
Middle-Upper Jurassic	(Quartz sandstone and quartz greywacke with siltstone and shale.	915'	882'	Alexander Formation
	(Sandy, siltstone and shale.	1797'	?130' (115-195)	
Upper Permian	"	?1927'	?185' (120-260)	
Lower Permian	"	?2112'	?112' (50-115)	?Grant Formation
Precambrian	Gneiss	2224'	4'+	
		T.D. 2228'.		

TABLE 3.

BMR5, Giralia : Stratigraphic Summary

Age	Lithology	Depth (R.T.) Top	Thickness	Formation
Upper Cretaceous	Calcarenite and calcilutite	-	110'(+)	Korojon Calcarenite
Lower or Upper Cretaceous	Greenish-grey claystone	110'	155'	Upper Gearle Siltstone
	Black pyritic shale and siltstone with very fine-grained glauconitic sandstone	265'	1245'	Lower Gearly Siltstone / Windalia Radiolarite / Muderong Shale
Lower Cretaceous	Glauconitic quartz sandstone	1510'	60'	Birdrong Formation
?Jurassic	Carbonaceous shale, siltstone and very fine-grained quartz greywacke.	1570'	120'	?Learmonth Formation
Lower Permian	"	?(1570-1690)	380'+	Byro Group
		T.D. 2070'.		

TABLE 4

Correlation Muderong Stratigraphic Bores

BMR 6					BMR7				
From	To	Thickness	Formation	Lithology	From	To	Thickness	Formation	Lithology
0	70	70'	Baker Formation	Fine grained quartz greywacke	0	190	190'	Coolkilya Greywacke	Quartz greywacke
70	285	215'	Norton Greywacke	Fine grained quartz greywacke	190	500	310'	Baker Formation	Quartz greywacke and siltstone
285	565	280'	Wandagee Formation	Fine grained quartz greywacke and siltstone	500	740	240'	Norton Greywacke	Sandstone and quartz greywacke
					740	1020	280'	Wandagee Formation	Quartz greywacke, siltstone and claystone.
565	T.D. 1002	437+'	Cundlego Formation including Quinnanic Shale	Siltstone with small scale slumping.	1020	1215	195'	Quinnanic Shale	Claystone
					1215	T.D. 1997	782+'	Cundlego Formation	Claystone, siltstone and quartz greywacke.

GEOLOGY OF THE GEORGINA REGION

Compiled from data sheets available in September 1958.

0 4 8 16 Miles

N

22° 138° 22°

23°

22° 138° 139° 30' 141° 24°

REFERENCE.

CAINOZOIC

	Cza	Alluvium, soil.

TERTIARY.

Mt Cooley Sinter	Tc.	Sinter, pisolitic limestone, chalcedony.
Springvale Sinter	Tv.	Sinter, silicified limestone, sandstone, chalcedony; ostracods, diatoms.
Noranside Limestone	Tn.	White limestone, red pisolitic limestone, chalcedony; ostracods, diatoms, gasteropods.
Austral Downs Limestone	Ta	
	Tl	Leached, silicified or lateritised sediments.
Marion Formation	Tm	Sandstone, sandy siltstone, conglomerate.

MESOZOIC.

	Kw/Kl	Calcareous, glauconitic sandstone, fine grained sandstone, concretions, wood.
Wilgunyah Formation	Klw	Grey and blue claystone and siltstone, sandy siltstone, fine grained sandstone, marine fossils
Toolebuc Member	Klwt	Sandy limestone, calcareous sandstone and siltstone, concretions.
Longsight Sandstone	Kll	Sandstone, sandy siltstone, conglomerate; wood, plants, marine fossils.
	M	Undifferentiated sandstone, conglomerate, ferruginous sandstone; wood, plants.

PERMIAN.

	P	Sandstone, conglomerate, probably fluvioglacial; wood.

ORDOVICIAN

	?O	Undifferentiated sandstone.
Mithaka Formation	Omm	Siltstone, sandy siltstone, sandstone with gypsum; marine fossils.
Toko Sandstone	Omt	Sandstone with clay pellets; marine fossils.
Nora Formation	Omn	Olive siltstone, sandstone, limestone, coquinite.
Coolibah Formation	Omc	Limestone, chert, dolomite, marine fossils.
Kelly Creek Formation	Okk.	Sandstone, siltstone, chert, marine fossils.
Swift Formation	Os	Siltstone, sandstone, chert, limestone, marine fossils.
Namarco Formation	Oln.	Limestone, dolomite, chert, sandstone; marine fossils.

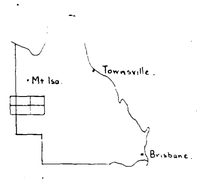
CAMBRIAN.

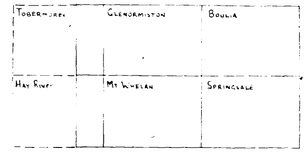
Chatsworth Limestone	€uc.	Limestone (calcarenite, calcilutite, marl), marine fossils.
Gola Beds	€uo	Limestone (calcarenite, calcilutite), marine fossils.
O'Hara Shale	€uh.	Shale, sandstone.
Pomegranite Limestone	€up.	Limestone (calcilutite, marl); marine fossils.
Georgina Limestone	€ug	Limestone (calcilutite, calcarenite, marl), sandy limestone, marine fossils.
"Transition Beds"	€u/€m	Limestone, marine fossils.
Steamboat Sandstone	€ms	Sandstone leached calcareous sandstone; marine fossils.
Beetle Creek Formation	€mb.	Siltstone, chert, silicified limestone, marine fossils.
Blazan Shale	€me.	Siltstone, shale, usually leached.
Undifferentiated	€m	Undifferentiated beds limestone, sandstone, marine fossils.

PRECAMBRIAN.

Sylvester Sandstone	P/€b.	Sandstone, silicified sandstone.
Sunhill Beds	€/€uk	Arkose, arkosic sandstone, sandstone, greywacke, siltstone, dolomitic sandstone, dolomite, conglomerate.
Makbat Sandstone	P.um.	Sandstone, siltstone, conglomerate.
Field River Beds	P.ut	Boulder beds (? fluvioglacial), green mudstone.
	Pt	Undifferentiated metamorphic and volcanic rocks, granite.

- Formation boundaries
- Monoclinal axis
- Synclinal axis
- Anticlinal axis
- Fault
- ?— Doubtful fault
- Attitude
- Vertical dip
- Horizontal beds
- Pb Lead show
- Main road
- ·B Bore
- ▫ Habitation





FOUR MILE SHEETS.