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The Geology of the Chinchilla 1:250,000 Sheet Area, Southern Queensland

by

N.F. Exon, R.F. Reiser*, A.R. Jensen, D. Burger and B.M. Thomas

(*Geological Survey of Queensland)

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THE GEOLOGY OF THE CHINCHILLA 1:250,000 SHEET AREA, SOUTHERN QUEENSLAND.

SUMMARY

During 1967 the exposed rocks in the Chinchilla 1:250,000 Sheet area were mapped, and a brief subsurface study followed. This area forms the north-eastern margin of the Surat Basin. Palaeozoic rocks crop out in the north and east, and younger rocks lap onto these from the south and west. In the east is the Yarraman Complex, which consists of anatectic granites and metamorphics of probable Permian age. The granites have intruded the strongly folded Carboniferous Yarrol Basin sequence of volcanics and marine sediments, and the contact between the Yarraman Complex and the main Carboniferous body is longitudinally faulted. The Yarrol Basin is fundamentally a graben, and is bounded on the west by the Upper Palaeozoic Auburn Complex, from which a tongue of granite extends into the central north of the Chinchilla area. In the subsurface, volcanics and sediments related to the Yarrol Basin sequence form the basement everywhere west of the Yarraman Complex.

The basement surface, although irregular in detail, overall dips away very gently to the south and west until the faulted eastern side of the meridional Mimosa Syncline is reached. Here basement drops away comparatively rapidly to perhaps 20,000 feet in the axis of the syncline, which is just west of the Sheet area. There has been no real tectonism since late Carboniferous times, but epeirogenic movements have caused block faulting and gentle warping throughout the later geologic record. The sequence in the post Carboniferous to Cretaceous rocks is essentially conformable.

Permian and Triassic rocks of the Bowen Basin sequence are confined to the subsurface, in the Mimosa Syncline. Much of the Permian sequence consists of volcanics or sediments derived from volcanics; the lower Permian is largely marine, the Upper Permian freshwater. The Triassic sequence consists essentially of freshwater sediments, with red-beds in the lower part, and normal sediments in the upper part.

The Lower Jurassic Precipice Sandstone, which is regarded as the base of the Surat Basin sequence, extends some distance out of the syncline but is itself overlapped by the Evergreen Formation. Younger Mesozoic rocks, which may have overlapped the Evergreen Formation, were eroded back in late

Cretaceous and Tertiary times and now form a series of arcs in the west and south, dipping very gently basinwards. The Lower Jurassic Hutton Sandstone and the Lower Cretaceous Blythesdale Formation are fairly clean stream sediments. The intervening Injune Creek Group and Orallo Formation contain abundant intermediate volcanic detritus, and were laid down in generally quiet freshwater conditions. Marine Lower Cretaceous rocks are present in the south-west corner.

In this area the greatest thickness of sediments is developed in the Mimosa Syncline. There are many thousands of feet of Permian volcanics and sediments, 3000 feet of Triassic freshwater deposits, more than 4000 feet of Jurassic and Lower Cretaceous freshwater sediments, and perhaps 1000 feet of marine Cretaceous sediments.

The basinward dip probably developed in late Cretaceous or early Tertiary times, and Cainozoic sediments unconformably overlie the older rocks. A period of deep weathering caused leaching and toughening of early Tertiary and older rocks. Later, Tertiary volcanics of probable early Miocene age were extruded in the Bunya Mountains, and up to 400 feet of these cover much of the south-east corner of the area. The Condamine River and its major tributaries have deposited up to 300 feet of late Tertiary alluvia. At present both erosion and deposition are continuing.

Oil exploration companies have drilled 22 wells in the Chinchilla Sheet area, mainly on the eastern side of the Mimosa Syncline, with no success to date. Aeromagnetic and seismic surveys have covered most of the prospective area. The main targets are the lower part of the Precipice Sandstone and any sandstone bodies in the Evergreen Formation; the main source rocks are believed to be in the Evergreen Formation. Some interest is also shown in the marine Permian beds.

Subartesian water is obtained from Jurassic and Lower Cretaceous sandstones by innumerable bores; most supplies are quite small but are generally useful for stock purposes. There are only two flowing bores in the area. Blue metal is obtained from quarries in the basalts of the south-east. During this survey several thick seams of good-quality bentonite were discovered in the Upper Jurassic sequence north of Miles, but economic deposits have yet to be proven.

INTRODUCTION

This report presents the results of a joint geological survey, by the Bureau of Mineral Resources and the Geological Survey of Queensland, in the Chinchilla 1:250,000 Sheet area on the north-eastern margin of the Surat Basin. The survey continued the project of mapping the Queensland part of the Great Artesian Basin. J.C. Rivereau of the I.F.P. prepared a photogeological map of the area (Rivereau, 1966) before mapping commenced.

The area was mapped in the five months from June to October 1967. The party consisted of N.F. Exon (party leader) and B.M. Thomas (B.M.R.) and R.F. Reiser (G.S.Q.). Thomas and Reiser worked on this Sheet for only part of the field season. Drafting was by D. Pillinger. Palynologist D. Burger was with the party for six weeks, and A.R. Jensen for three weeks. Marine fossils were examined by J.M. Dickins and D. Strusz, plant fossils by Mary White, and palynological examination was carried out by D. Burger. Notes on the Chinchilla Sand by A. Bartholomai and J.T. Woods of the Queensland Museum are included in the text. The boundaries shown on the map, however, are the responsibility of the party. Shallow drilling was carried out by the Petroleum Technology Section of the Bureau of Mineral Resources Branch under party supervision.

The rough division of work was:-

Exon - 21 weeks mapping of the northern two-thirds of the area. Carboniferous to Quaternary. Most of text including subsurface work.

Reiser - 5 weeks mapping of central and eastern south. Jurassic, Tertiary and Chinchilla Sand. Some related parts of text, also previous geological investigations and part of economic section including water.

Jensen - 3 weeks mapping in northeast: Carboniferous sequence, granites and schists.

Burger - 6 weeks mapping in northwest: Middle Jurassic to Quaternary.

Thomas - 4 weeks mapping in southwest corner. Jurassic to Quaternary. The field work and report writing was organized by Exon.

The area consists largely of up to 4000 feet of Permian to Cretaceous sediments (only Jurassic and Cretaceous crop out) which overall dip very gently to the southwest. They lap onto basement rocks consisting of granite, gneiss, and Carboniferous volcanics and sediments, which crop out in the northeast. In the west, basement drops gently away into the meridional Mimosa Syncline, and the sedimentary sequence thickens to 10,000 feet or more (20,000 feet suggested by aeromagnetic data). In the southeast Tertiary basalt flows have an aggregate thickness of 400 feet.

Sandy soils predominate on the Lower Jurassic sandstones, and the granites and gneisses. Sedimentary clay soils predominate on the remainder of the Jurassic and the Cretaceous, except where deep gilgaied clays form plains. The sandy soils naturally support open forest, or eucalypt scrub, and the clayey soils brigalow scrub. However the clay soils, in particular, have been extensively cleared.

Figure 1 shows the main cultural features of the area which has a population of about 30,000 people, mainly in the south. Towns and villages are concentrated along the Brisbane-Charleville and Dalby-Jandowae railway lines. The only other noteworthy population centres are Bell in the dairy country of the southeast, and Condamine in the southwest, on the Condamine Highway between Dalby and Roma. Chinchilla is the largest town (population 6000) with Miles and Jandowae about half as big.

A large dairy industry is concentrated in the east and southeast, on the better soils derived largely from basalt. The larger towns have butter factories. Cash crops, and feed crops for stock, cover large cultivated areas in the southeast. The pastoral industry, based on cattle in the north and sheep in the south, is largely confined to the western two thirds of the area. Nearly one quarter of the area (north of Chinchilla) consists of forestry leases which provide pine, spotted gum and stringy bark for numerous sawmills. A narrow-gauge railway line carries sawn timber and firewood from Barakula to Chinchilla. There is a brick works at Chinchilla.

Two major highways, that linking Chinchilla and Miles with Roma and Dalby, and the parallel Condamine Highway to the south, and numerous other sealed roads provide excellent access to most of the south, and a sealed road and branch railway line connects Wandoan, (Roma Sheet) to the northwest, with Miles. Access elsewhere is largely by good formed roads, which are particularly common in the forestry areas.

There are frequent rail services to Brisbane, and scheduled passenger flights land at Condamine and Chinchilla, and at Dalby immediately south of this area.

Aerial photographs taken by Adastra Airways in 1963, at an approximate scale of 1:83,000, are available for the whole area. A planimetric map at a scale of 1:250,000 is currently being produced by the Department of National Mapping, and an early compilation of this was used as a basis for the geological map. Planimetric maps covering the area at a scale of 4 miles to 1 inch are available from the Department of Public Lands, Brisbane.

Water supplies are obtained by bores from various aquifers. In general they are pumped from shallow depths, but there are a few flowing bores in the southwest. Earth tanks and dams are particularly common in the dissected country of the north and east.

Details of shallow scout holes drilled during the season and their grid references, are given in Appendix 3. Graphic logs are shown in various plates and figures (see Contents). Cores and cuttings are stored at the Bureau of Mineral Resources Core and Cuttings Laboratory, Fyshwick, A.C.T. Nine holes were drilled in the area, three of them at the one site to investigate a bentonite prospect.

The two marine fossil collections (G.R.393767; 417764), prefixed SB, are stored at the Bureau of Mineral Resources. Plant fossil collections (White, 1967) are also prefixed SB and are stored at the Bureau of Mineral Resources.

Evans' palynological divisions of the Permian (Evans, 1964a) and Mesozoic (Evans, 1966a) are used in the text.

Localities given in brackets thus, (3800 6600) refer to the 10,000 yard military grid covering the area.

Nomenclature

Crook's (1960) classification of arenites is followed. "Arenite" is used as the generalized non-genetic term for sand-sized clastic material. The generally accepted arbitrary figure of 75% matrix is taken as the division between arenite and mudstone. All the arenites described fall into his genetic subdivision of 'sandstone' - traction current deposits. The term 'quartzose' is applied to those sandstones with quartz forming more than 90% of the clasts; if quartz forms 75% to 90% of the clasts the term 'sublabile' is applied; and if less than 75% of the clasts, the term 'labile' is applied. If the feldspar:lithics ratio is greater than 3:1, or less than 1:3 respectively, the qualifying terms 'feldspathic' or 'lithic' can be used with 'sublabile sandstone'; and 'labile sandstone' can be 'feldspathic sandstone' or 'lithic sandstone'.

"Siltstone" is used as a grainsize term (1/16mm to 1/56mm). The term "mudstone" is used as a general term for non-fissile sediments of the lutite class, and "shale" is defined as a fissile mudstone. "Claystone" is used for sediment consisting dominantly of clay minerals.

The Wentworth Scale has been followed for grain size terminology (Pettijohn, 1957; also see Plate 10). Bedding terminology follows that proposed by McKee and Weir (1943).

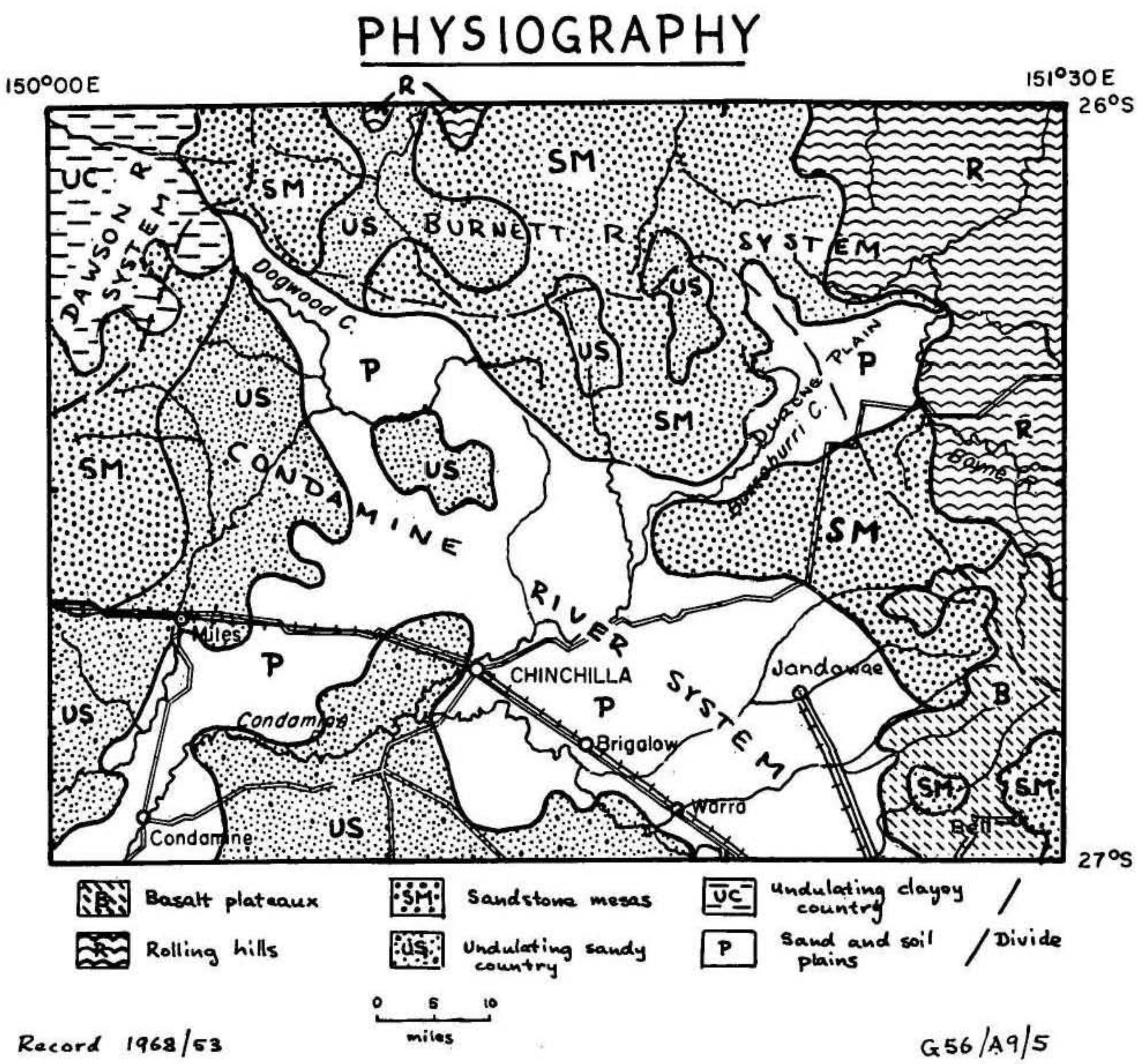
PHYSIOGRAPHY

Drainage in the area is to the Condamine, Burnett and Dawson Rivers (see Fig.1). The Condamine River is part of the Darling River System. The Burnett and Dawson Rivers flow into the Pacific Ocean.

Apart from the Condamine River and some tributary creeks, watercourses flow only after heavy rain. Holes in creeks in the sand and soil plains of the Condamine River System normally contain some water.

The area has been divided into physiographic regions as shown in Figure 1. The basalt plateaux region in the southeast consists of dissected basalt flows which form flat-topped hills above steep-sided valleys. This is the highest region in the area, the tops of flows rising from 1400 feet in the west to over 2000 feet in the east. The granites and gneisses in the northeast give rise to the typical rolling hills of granite country, with rounded rises and V-shaped valleys, and tors capping some ridges. The general elevation of the country falls northwards, following the Boyne River, from 1500 feet to 700 feet.

Fig. 1



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The sandy Jurassic sediments and the tough deep weathering-profile form steep-sided sandstone mesas with wide valleys where erosion is at an early stage, and undulating sandy country consisting of plains and a few small mesas, where it has progressed further. Where the deeply weathered sandstone crust has been stripped from the unresistant sediments of the Jurassic Injune Creek Group, a low area (less than 1000 feet) of undulating clayey country has resulted.

The wide shallow valleys of the Condamine River System form soil and sand plains, with material derived from the surrounding units.

In early Tertiary times, a period of steady rainfall and little runoff resulted in a leached profile with a tough crust being developed. This old land surface, which generally sloped gradually southwards, is preserved on isolated hills in the north, and quite widely in the south and west. Basalt in the southeast poured down valleys running westwards; the westerly slope in that area was caused by pre=Miocene tilting.

Most of the area has been steadily eroded since. Hills in the north were cut down and the outwash plain of the Condamine River System spread steadily northwards, as the streams reached base level. The Dawson and Burnett River Systems cut back steadily from the north, but gradients are still too high for much deposition by these systems in this area. These processes of erosion and deposition are still continuing.

PREVIOUS INVESTIGATIONS

Geological

The Sheet area was first mapped by Jack & Maitland (1894) as part of a geological reconnaissance of inland Queensland. They mapped five formations, the most extensive being the "Ipswich Beds" (Upper Trias-Jura) and the "Desert Sandstone" (Upper Cretaceous). The "Ipswich Beds" were shown in a wide curved belt in the northern and eastern parts of the Sheet area, with several smaller areas of outcrop along the Condamine River. The southwestern corner of the Sheet area was shown as Desert Sandstone, its northern boundary passing just to the north of Warra, Chinchilla, and Miles. Within the larger area of "Ipswich Beds" there are isolated areas of basalt southeast of Jandowae; on Charley's

Creek near Chinchilla, Rolling Downs Beds (Upper Cretaceous) were shown as a small area surrounded by an annulus of Blythesdale Beds (Lower Cretaceous). The "Ipswich Beds" correspond approximately to the Jurassic sediments of the present mapping, while the "Desert Sandstone" covers most of the areas of deep weathering. Cretaceous sediments were mapped on the basis of an outcrop of shale in Charley's Creek, which Jack & Maitland (op. cit.) regarded as an inlier of the "Rolling Downs Beds". The presence of Blythesdale sediments was assumed. Neither of these units was recognised in the present mapping, and it is thought that Jack & Maitland mistook part of a deep weathering-profile for Rolling Downs equivalents.

In a visit to the Bunya Mountains area, Jack (1896) reported finding sedimentary rocks comparable to his "Triasso-Jurassic Coal Measures" between 2 beds of basalt, and concluded that the basalt was contemporaneous with the coal measures. He considered further, that the basalt had "suffered considerable denudation before the deposition of sedimentary rocks west of Jimbour", and that, for this reason, there was an unconformity in the Triassic-Jurassic sequence. These conclusions are not in accord with present findings. Jack (op. cit.) records the occurrence of Palaeozoic rocks of near-vertical dip and northerly strike in the valley of Cadarga Creek; these have been mapped as Carboniferous in the present survey.

Coal occurrences near Jimbour and Chinchilla were investigated by Cameron (1910) and Marks (1910) respectively. Cameron regarded the Jimbour coals as part of a continuous belt stretching 100 miles to the southeast, and 200 miles northwest to the head of the Dawson River; he assigned them to the upper part of the Trias-Jura System, unconformably overlying older rocks to the north and east and unconformably overlain to the southeast by the Upper Cretaceous Desert Sandstone. Marks (op. cit.) listed coal occurrences at depth at Chinchilla, Burncluith, and Baking Board, and in outcrop in Charley's Creek.

The strata referred to as "the upper part of the Trias-Jura System" by Cameron (1910) are probably equivalent to the "Walloon Series" as used by Walkom (1918). Walkom (op. cit.) ascribed a Lower to Middle Jurassic age to the "Walloon Series" on floral evidence. He described the Queensland outcrop of the unit as being "a probably continuous belt from the New South Wales border near Killarney, running through Warwick to Dalby and Chinchilla, then swinging round to an east and west direction parallel to the railway-line past Roma". The Series appears to include most of the Jurassic sediments mapped on the Chinchilla Sheet area. The small scale of Walkom's map does not allow a more accurate correlation to be made.

Jensen (1926a) covered that part of the Sheet area west of Chinchilla and north of the Chinchilla-Roma railway line. He recognised two major divisions in this area, the Upper Triassic "Bundamba Series", and the Jurassic "Walloon Series", and further subdivided the latter into five units of differing lithology:

5. sandstone, shale, with minor coal - Upper Walloon
4. calcareous sandstone, feldspathic sandstone, carbonaceous beds - Orallo Coal Measures.
3. thick sandstone.
2. highly calcareous, fresh and brackish water formation of coal, kerosene shale, limestone and calcareous sandstone - Injune Creek.
1. basal feldspathic sandstone.

The Bundamba-Walloon boundary follows fairly closely the boundary between the Lower and Middle Jurassic sediments as mapped currently. The suggested correlation of the basal sandstone of the Walloon Series with the Marburg Beds of the Rosewood district has since been shown to be incorrect.

Ball (1931) reported the occurrence of plentiful silicified and "ferrated" fossil wood from Guluguba, along with impressions of fossil plants; Neocalamites, Ptylophyllum, and cf. Gleichenites, also Nilssonia were found in a shale near Burunga. Ball (op. cit.) was the first to comment on deep weathering effects on the Sheet area. He described "outliers of an escarpmented plateau" - "scarped mesas" with "table tops" - "which slope gently south from the Main Range on the Miles Road, with alluvials, laterites, and porcellanites". He considered them to "form part of a widespread duricrust of the interior".

Coals of the Walloon Series at Warra were investigated by Cribb (1944). He also described sands and gravels containing vertebrate bones, and concluded that they were "probably post-Tertiary fluviatile deposits of limited extent". Current thinking on the relative ages of the vertebrate fossil deposits in this area agrees with this conclusion. The vertebrate fossil deposits of Chinchilla and Brigalow were also grouped by Bryan and Jones (1946) within the Pleistocene Diprotodon beds; the work of Woods (1956, 1960) has since shown that these are more probably of Pliocene age.

Sturmfels (1954) mapped the Miles-Wandoan area; he recognised the "Lower Walloon Series" to the north of Gurrulmundi and overlying this unit to the south, the Gubberamunda Sandstone, "Fossil Wood Beds", Mooga Sandstone, and "Transition Beds" of the "Blythesdale Series". The "Lower Walloon Series" corresponds approximately to the Injune Creek Group of present usage, and the boundaries of the two units agree fairly well. However only the "Fossil Wood Beds" (Orallo Formation of Day, 1964) and the undifferentiated Blythesdale Formation (Day, op. cit.) are recognizable in the south. The Gubberamunda Sandstone disappears just west of this area, and the Mooga Sandstone and the "Transition Beds" are no longer distinguishable.

In a survey of the brigalow lands of Eastern Australia, Isbell (1962) recorded two categories of soil on the Chinchilla Sheet area which support a brigalow dominated vegetation: the sedentary clay soils, developed from fresh water shales and feldspathic sandstone (he quotes the Walloon Coal Measures as an example); and deep gilgaied clays, superficial deep clay deposits unrelated to underlying consolidated rock. The sedentary clay soils in the northwestern corner of the Sheet cover much of the Injune Creek Group as mapped, while in the southeast around Jandowae and Bell, they are developed on the Evergreen Formation. The deep gilgaied soils occur within those areas mapped herein as Czc.

The Chinchilla Sheet area was mapped on a regional scale by McTaggart (1963a). There is close agreement between his conclusions and those of the present survey; discrepancies arise from differences in interpretation and in the scale of mapping. The main difference lies in the interpretation of the Evergreen/Hutton sequence. McTaggart drew his Evergreen-Hutton boundary at the top of the oolitic ironstone band. In the present record, the Evergreen Formation and the Hutton Sandstone are used in the sense of Jensen, Gregory and Forbes (1964), and siltstone and sandstone above the ironstone is included in the lower unit. McTaggart recognized that there was a significant lithological change at this stratigraphic level, since he has mapped it as the "top of the Lower Marburg Sandstone" within his Hutton Sandstone.

Geophysical

Geophysical surveys by companies and the Bureau of Mineral Resources are tabulated in Table 1. These have been concentrated in the sedimentary areas of the west and south. Regional gravity work by the Bureau of Mineral Resources (B.M.R., 1965) covers the whole area and is generalized in Figure 9. It follows very well the known basement slope. Gravity rises steadily from the Mimosa Syncline to the west to the Palaeozoic outcrops at Cadarga dip reflecting the high density of these volcanics and indurated sediments. It also defines the Chinchilla Ridge. Over the granites in the east gravity falls somewhat. The low gravity area in the southeast could represent the Triassic trough believed to extend from the Ipswich Basin.

The aeromagnetic work for Union Oil Company in the west is summarised and partly re-interpreted, by Aero Service Corporation (1963). This also reflects basement and defines the eastern flanks of the Mimosa Syncline. It also shows the swing to an east-west trend in the south of the area.

Seismic work for Union Oil Co. (e.g. Kahanoff, 1962b; United 1964, 1966) and Phillips Petroleum Company (Fjelstul and Beck, 1963) defines the structure in more detail in the west and south. In particular it delineates the faults on the eastern flank of the Mimosa Syncline. In this area of poor outcrop seismic has been the main tool in positioning oil wells, the most useful horizon being "Top Precipice". Seismic work in a small area in the centre of the Sheet was done for Condamine Oil Company (McQueen and Warner, 1962; Warner and Klaudt,1963 and re-interpreted by C.G.G. (1963).

TABLE 1 - GEOPHYSICAL SURVEYS

Survey	Organization	Reference
Gravity along seismic lines; far south	Bureau of Mineral Resources	Darby, 1965
Regional gravity	Bureau of Mineral Resources	Lonsdale, 1965
Regional gravity	Bureau of Mineral Resources	B.M.R., 1965
Regional gravity	Bureau of Mineral Resources	Langron and van Son, 1967
Aeromagnetic; west	Union Oil Devel. Corp.	U.O.D., 1960
Aeromagnetic; west	Union Oil Devel. Corp.	Kahanoff, 1962a
Aeromagnetic; west	Union Oil Devel. Corp.	Aero Service Corp.1963
Reconnaissance seismic;	Union Oil Devel. Corp.	Kahanoff, 1962b.
Detailed seismic; small central area	Condamine Oil Co.	McQueen and Warner, 1962.
Detailed refraction seismic; small central area	Burmah Oil Co.	Warner and Klaudt, 1963.
Reinterpretation of earlier seismic in central area	Condamine Oil Co.	C.G.G., 1963
Reconnaissance and detailed seismic; southeast	Phillips Petroleum Co.	Fjelstul and Beck, 1963.
Detailed seismic; west	Union Oil Devel. Corp.	United, 1964
Detailed seismic; southwest	Union Oil Devel.Corp.	United, 1966

Exploratory drilling for oil and gas

Most of the Chinchilla Sheet area was early recognized to be unprospective for hydrocarbons. Basement crops out in the northeast, and is encountered at shallow depth in water bores over much of the north, centre and east of the Sheet. Only in the west and south is there a considerable sedimentary sequence overlying basement.

Oil interest in this part of Queensland from 1900 until 1962 was largely confined to the Roma area. The only early wells in the Chinchilla area were M.O.C. No.1 (Boyanda) near Miles, which gave minor gas shows, and Condamine Speculation No.1 on the Chinchilla Ridge, which was dry.

In the early 1960's Union Oil Co. took out Authority to Prospect 71P, which included the western part of this area. After aeromagnetic and seismic surveys they drilled several holes in and near this Sheet area. Of these U.K.A. Burunga No.1 gave good gas shows, and U.K.A. Conloi No.1 tested at 400 barrels of oil per day. The discovery of oil at U.K.A. Cabawin No.1 to the south in 1962 gave additional momentum to the search. Further seismic work was followed by the drilling of another 14 holes on this Sheet, with no success. These were generally sited on or near the culmination of small fault-controlled anticlines on the faulted eastern flank of the Mimosa Syncline, and were aimed either at structural traps, or pinch outs on anticlinal flanks. U.K.A. Bennet No.1, to the south on Dalby Sheet, which is capped as an oil producer, was the only new successful well in the vicinity.

Phillips Petroleum Co. has drilled two holes south and southeast of Chinchilla on Dalby Sheet, but neither was successful.

SUBSURFACE UNITS (CARBONIFEROUS-LOWER JURASSIC)

[illegible] The units described here are tabulated below, and our nomenclature is compared with that of Union Oil Company, and the outcrop nomenclature of Mollan, Forbes, Jensen, Exon and Gregory (in prep.). Only the Carboniferous-Permian? crops out in this area.

This record	Union-Kern-A.O.G.	Outcrop to north
Precipice Sandstone	Precipice Sandstone	Precipice Sandstone
Wandoan Formation	Wandoan Formation	(Moolayember Formation (+ Clematis Sandstone
Rewan Formation	Cabawin Formation	Rewan Formation
Back Creek Group	Back Creek Formation	Back Creek Group
Carboniferous-Permian?	Kuttung Formation + Cracow Formation	

Detailed descriptions of the outcrop units are given by Jensen, Gregory and Forbes (1964), and of the subsurface units by Union Oil Co. in various reports, especially the published report on U.K.A. Wandoan No.1 and U.K.A. Burunga No.1 (U.K.A., 1964a), and that on U.K.A. Cabawin No.1 (U.K.A. 1964b). A full list of subsidized drilling reports is given in Table 2, and of geophysical work in Table 1. Two summary reports on subsidized wells (Mack, 1964, 1965) are particularly relevant.

The geologists of Union Oil Co. (which holds the authority to prospect for the Mimosa syncline) have been the major workers in the subsurface in the area. Some work has also been done by Phillips Petroleum Company in the central south (mainly on Dalby Sheet) and for Condamine Oil Company in a small area north of Chinchilla.

For this record we have made a short study of subsidized wells, from wireline logs and company reports, and have attempted to build up a broad picture only.

The general structure of the area is shown in Plate 8. Some idea of the distribution of the subsurface units can be obtained from the well correlation charts (Plates 10,11), and the pre-Jurassic geology map (Figure 2). The map cross section also shows their relationship to surface units. From these various illustrations it can be seen that all the units described, apart from the Carboniferous-Permian? and the Precipice Sandstone, are confined to the Mimosa Syncline in this area. The Carboniferous-Permian?, which forms basement in all the wells, falls gently to the south and west from the outcrops in the northeast; it slopes more steeply (but still quite shallowly) into the Mimosa Syncline in the west. The younger units gradually filled the Mimosa Syncline (and the low area to the south) and overlapped each other up the eastern flank of the syncline. Jurassic sediments covered most of the basement area outside the syncline, but have been partially eroded since. The units are generally conformable, but there are regional unconformities at the base of the Triassic Wandoan Formation and the Lower Jurassic Precipice Sandstone. Block faulting occurred on the eastern flank of the gently but steadily subsiding Mimosa Syncline during sedimentation, and preservation of sediments in some areas is often related to this faulting.

Carboniferous-Permian?

All the pre-Back Creek Group volcanics and indurated sediments struck in the wells are considered under this heading. Typical subsurface lithologies, as described in well completion reports, from northwest to southeast are:

(1) U.K.A. Burunga No.1 White to green welded tuff and andesitic flows, Union's "Cracow Formation").

(2) Condamine Speculation No.1. Volcanic sandstone and conglomerate, agglomerate and tuff.

(3) U.K.A. Picurda No.1. Multicoloured tuffaceous sandstone and conglomerate (Union's Kuttung Formation).

(4) Phillips Kogan No.1. Massive basalt (Phillips' "Kogan basalt").

(5) Phillips Yarrala No.1. Black shale, green and grey phyllite, coarse pebbly sandstone, basalt.

TABLE 2. OIL DRILLING

NAME OF WELL	YEAR DRILLED	GRID REFERENCE	TOTAL DEPTH (Feet)	HYDROCARBON SHOWS	REFERENCE
Murilla Oil Co.No.1 (Boyanda)	1935-1953	304691	?4721	Gas at some levels	
Condamine Speculation No.1	1948-1963	363713	2885	Some oil and gas shows	Mott & Associates, 1963.
U.K.A. Burunga No.1 *	1962	300770 (Mundubbera Sheet)	10242	Fluorescence in Precipice ; Traces gas and oil in Kianga tuff 4179'. Back Creek gas shows from 7480' to 8015'.	U.K.A., 1964.
U.K.A. Mackie No.1 *	1963	330656	3969	Gassy fresh water from Precipice (3754' - 3770')	Union, 1963.
Phillips Kogan No.1 *	1963	378640 (Dalby Sheet)	3438	No shows	Kyranis, 1963.
Condamine Canaan No.1 *	1964	364715	1635	No shows	McTaggart, 1964.
U.K.A. Picurda No.1 *	1964	325656	3995	"	Union, 1964a
U.K.A. Conloi No.1 *	1964	289718	6005	Production test in Evergreen: 4313'-4321', 400 bbl	Union, 1964b
U.K.A.Gurulmundi No.1 *	1964	296718	4784	No shows	Union, 1964c
U.K.A. Tin Hut No.1	1964	310723	3467	"	
U.K.A. Weringa No.1 *	1964	295758	4977	"	Union, 1965
U.K.A. Columboola No.1.	1965	319681	3925	"	
U.K.A. Dogwood No.1	1965	310687	4138	"	
Phillips Yarrala No.1 *	1965	416636 (Dalby Sheet)	2955	"	Meyers, 1965.
U.K.A. Auburn No.1	1966	297703	6114	"	
U.K.A. Binky No.1	1966	319728	1978	"	
U.K.A. Bullock Ck.No.1	1966	327722	1650	"	
U.K.A. Bulwer No.1	1966	318677	3917	"	
U.K.A. Burunga South No.1	1966	304752	8524	"	
U.K.A. Paddy Ck No.1	1966	300695	5259	"	
U.K.A. Pelham No.1	1966	323723	2051	"	
U.K.A. Range No.1	1966	296722	4440	"	

Note: Summary reports involving some of Unions' subsidized wells are also available (Mack, 1964, 1965). Unsubsidized wells are summarized in G.S.Q., 1960-64 and Queensland Mines Department, 1965, 1966.

*Subsidized by Commonwealth Government.

PRE - JURASSIC GEOLOGY

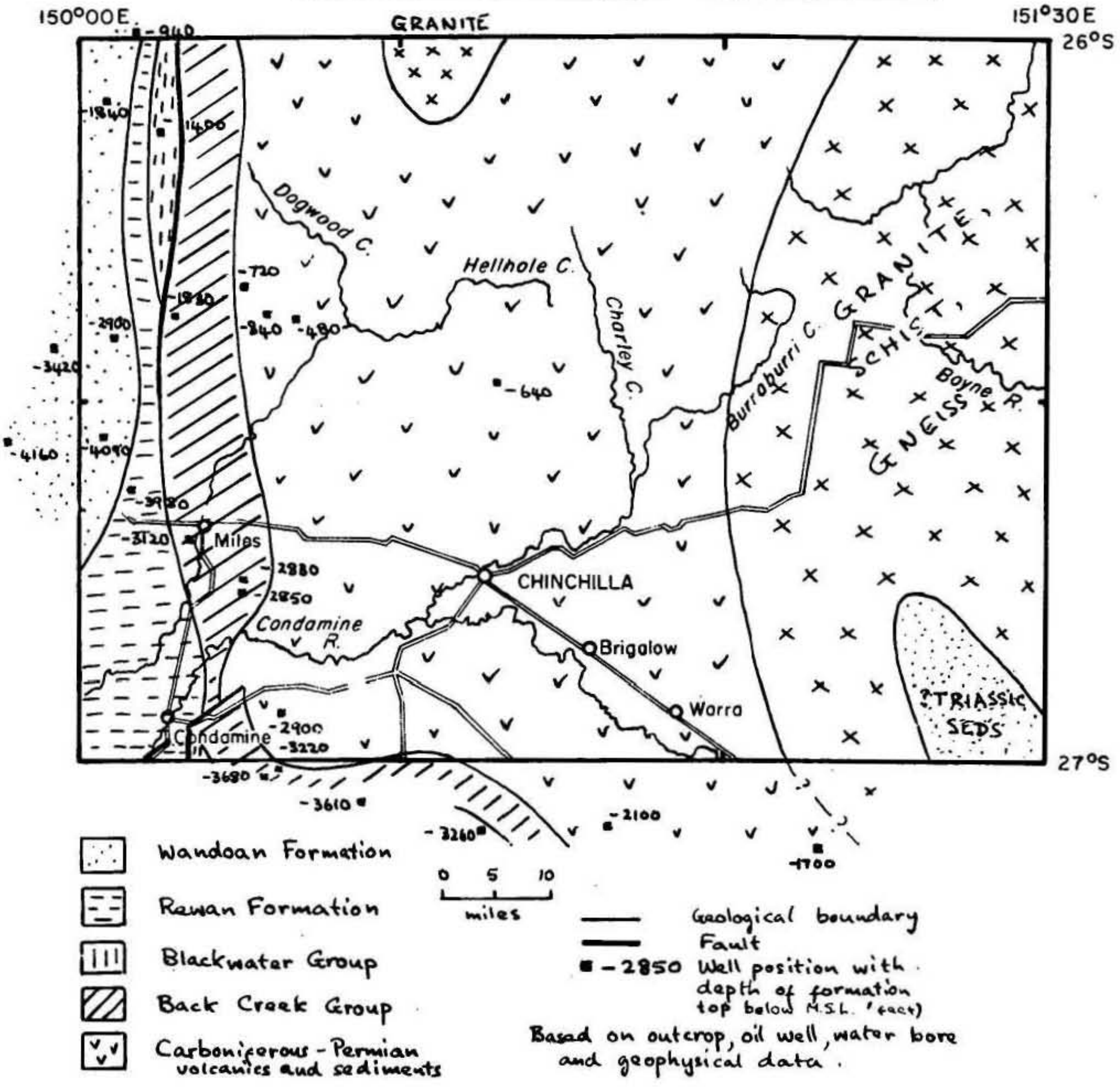


FIG. 2.

To accompany Record 1968/53

G56/A9/6

In outcrop in the Monogorilby area (Monogorilby School Grid Reference 401763) there are cherty volcanics and sediments, phyllitic sediments, tuffaceous sandstone, conglomerate and tuff, basalt flows and quartz-feldspar porphyrys, intermingled in a complex and as yet obscure manner. Two marine fossil localities in this material were found and the ages of these are Lower and lower Upper Carboniferous. All the subsurface lithologies can be fitted into this sequence, and the only definite age in the subsurface is a K/Ar age of early Carboniferous on the basalt in Phillips Kogan No.1. However the Camboon Andesite (Union's invalid name 'Cracow Volcanics') is Permian (Jensen et al., 1964) and without age data could not be distinguished in the subsurface from the Monogorilby sequence; hence the Carboniferous to Permian? age.

Back Creek Group

The name "Back Creek Series" was first used by Shell (Queensland) Development (Schneeberger,1951) for approximately 5700 feet of tuffaceous, partly fossiliferous clastics with basal limestone, exposed in Back Creek in the Cracow area. The name was published and defined in Minad (1959) as Back Creek Group and the constituent formations were also defined. They stated that the thickness varied from 2900 feet to 15000 feet.

The name Back Creek Group has been extensively used in the subsurface for marine Permian sediments which may or may not be entirely equivalent to the group of outcrop. The only thick development of the unit in this area for which a description is available is that in U.K.A. Burunga No.1, where it consists of 5144 feet of siltstone and shale, some tuffaceous sandstone, conglomerate, tuff and minor coal; marine macrofossils are present. In this well, as elsewhere in the area, it unconformably overlies the Carboniferous to Permian? sequence. The group dips away to the west into the Mimosa Syncline and is not reached by wells drilled on eastern Roma Sheet. It was deposited in conditions varying from marine to freshwater, and contemporaneous volcanism was an imported source of material. There were a number of gas shows in U.K.A. Burunga No.1.

Blackwater Group

The coaly, non-marine Blackwater Group (Malone, Olgers and Kirkegaard, in press) is named after Blackwater town in central Queensland where it consists of a number of formations. In outcrop in the Springsure area the group consists of the upper, coaly part of the superseded Bandanna Formation of Hill (1957).

On Chinchilla Sheet area its best development is in the northwest in the Mimosa Syncline. It is also present in the extreme southwest. In U.K.A. Burunga No.1 it consists of 2574 feet of coal measures and tuffaceous clastics. The main rock types are tuffaceous calcareous sandstone and conglomerate, silicified white tuff, carbonaceous shale and siltstone and lesser coal. Traces of oil and gas were found in a tuff in U.K.A. Burunga No.1.

The group was deposited in a variety of freshwater environments. Much of the detritus was provided by contemporaneous volcanism, and primary tuffs are common. The group contains a Glossopteris flora and spores of Evans' (1964a) division P4. It is of Upper Permian age and apparently conformable on the Lower Permian Back Creek Group.

Rewan Formation

The type area of the Rewan Formation (Hill, 1957) is near Rewan Homestead in the Springsure Sheet area where it is 1600 feet thick (Mollan et al., in press). Various workers (e.g. Tissot, 1963b; Bastian and Arman, 1965) have shown that the Cabawin Formation of Union Oil (U.K.A., 1964b) is very similar lithologically and in age to the Rewan Formation of outcrop, and have suggested its equivalence. The older name Rewan Formation is preferred for the interval in this record.

In outcrop in the Arcadia area (Mollan, Forbes, Jensen, Exon and Gregory, in prep.), in the axis of the Mimosa Syncline, the formation is estimated to be 12,000 feet thick, and seismic data suggests a similar thickness in the subsurface. The maximum thickness penetrated in this region is 4356 feet in U.K.A. Wandoan No.1. It thins very rapidly away from the synclinal axis. In the Chinchilla area it is confined to the Mimosa Syncline, where the thickest sequence penetrated is 1320 feet in U.K.A. Weringa No.1. The rock types, green tuffaceous sandstone and multicoloured siltstone and shale, are similar to those in the type area. The unit is not present on the Burunga Anticline.

This red-bed sequence contains no marine fossils and was probably a fluviatile and lacustrine deposit laid down in a continuously subsiding shallow basin. It contains Lower Triassic spores (Evans, 1964a).

Wandoan Formation

The type section of the Wandoan Formation is in U.K.A. Wandoan No.1 where it is 1287 feet thick (U.K.A., 1964a). Detailed petrological examination of cores and cuttings (Bastian and Arman,1965) has shown that the lower 519 feet is probably equivalent to the Clematis Sandstone of outcrop, and the upper 768 feet to the Moolayember Formation. The Clematis Sandstone part consists largely of sublabile sandstone containing volcanic detritus, with lesser conglomerate, siltstone and shale. The Moolayember Formation part consists of labile sandstone (with abundant mica, and oolites at some levels), siltstone and shale.

However the subdivision is not readily seen in the wireline logs, even in U.K.A. Wandoan No.1, and we cannot carry it into the Chinchilla Sheet area with the small amount of subsurface work we have done. Hence we follow Union's usage of Wandoan Formation for the whole interval.

The base of the Wandoan Formation is an unconformity and the formation is confined, in this area, to the Mimosa Syncline. In U.K.A. Wandoan No.1,Bastian and Arman (1965) believe, for petrological reasons, that the upper part of the Rewan Formation was eroded before deposition of the Wandoan Formation. In U.K.A. Burunga No.1 on the Burunga Anticline a thin veneer of Wandoan Formation covers the Permian Blackwater Group.

These pebbly to fine grained sediments contain much volcanic detritus which may possibly represent contemporaneous volcanism. The early sediments are largely coarse grained and fluviatile, but fine grained backswamp and possibly lacustrine sediments become more important with time as gradients diminished. Chamositic pellets

(Bastian and Arman, 1965) and acritarchs (Evans, pers.comm.) at some higher levels (Moolayember equivalent) suggest marine interludes. Spores in the unit are of Lower to Upper Triassic age.

Precipice Sandstone

The name "Precipice Sandstone" was first used by Whitehouse (1952) and later he (Whitehouse, 1954) stated that the type section was in the gorge of Precipice Creek. In outcrop it is largely cross-bedded, commonly clayey, quartzose sandstone, with a thin-bedded upper part.

In this area it unconformably overlies older units in all wells except the structurally high U.K.A. Pelham No.1 and U.K.A. Bulwer No.1. In the Mimosa Syncline it reaches a maximum of 554 feet thick in U.K.A. Weringa No.1. In the structurally lower areas, both parts of the formation (the lower pebbly porous part and an upper fine grained tight part) are present. In higher areas in the south, e.g. U.K.A. Picurda No.1, only the upper part is present. This suggests that present structure reflects the Precipice land surface in the south; energetic streams filled low areas initially and, as the relief became less, energy of transport decreased, and finer sediments were deposited largely in backswamps and possibly lakes, over wider areas. The presence of lower Precipice on the Burunga High (U.K.A. Burunga No.1) and parts of the Chinchilla Ridge (Condamine Canaan No.1, Phillips Kogan No.1) suggests that these were not high areas during Precipice deposition although they were in Wandoan times, and are at the present day.

No Precipice Sandstone has been mapped in outcrop in this area. Coarse sands in the base of the mapped Evergreen Formation around granite outcrops are mostly true arkoses. There are two possibilities involving these arkoses. The north and east may have been an entirely erosional area in Precipice times and the sands had "cleaned up" by the time they were deposited in the southwest (and possibly, in local lows in the north and east). Alternatively the basal Evergreen arkoses were deposited at the same time as the clean Precipice in the south and west. In this case there was a gradation from dirty to clean down the stream courses. The first alternative is the more attractive, as the style of deposition from Permian times was by onlap up the basement surface and this mechanism appears the simpler.

The formation belongs to Evans' (1964b) spore division J1 regarded as Lower Jurassic in age, and marked by the first appearance of abundant <u>Classopolis</u>.

DESCRIPTION OF OUTCROPPING ROCK UNITS

SUMMARY

The general sequence of outcropping rock units and their lithology and thickness are shown in Fig.3. The mapping in this area, particularly of the post Lower Jurassic Mesozoic rocks, was greatly hampered by wide expanses of Cainozoic sediments, and by the widespread intense weathering.

The overall setting is of a basement platform dipping to the south and west and then dropping sharply away into the meridional Mimosa Syncline of the west, the axis of which is just outside this area. Basement rises again to form the Roma Shelf further west. In the Chinchilla Sheet area basement can be subdivided into the Yarraman Complex of the east, which is bounded to the west by the "Yarrol Thrust" of McTaggart (1963a), the Yarrol Basin and related sequence in most of the rest of the area, and a small part of the Auburn Complex in the central north.

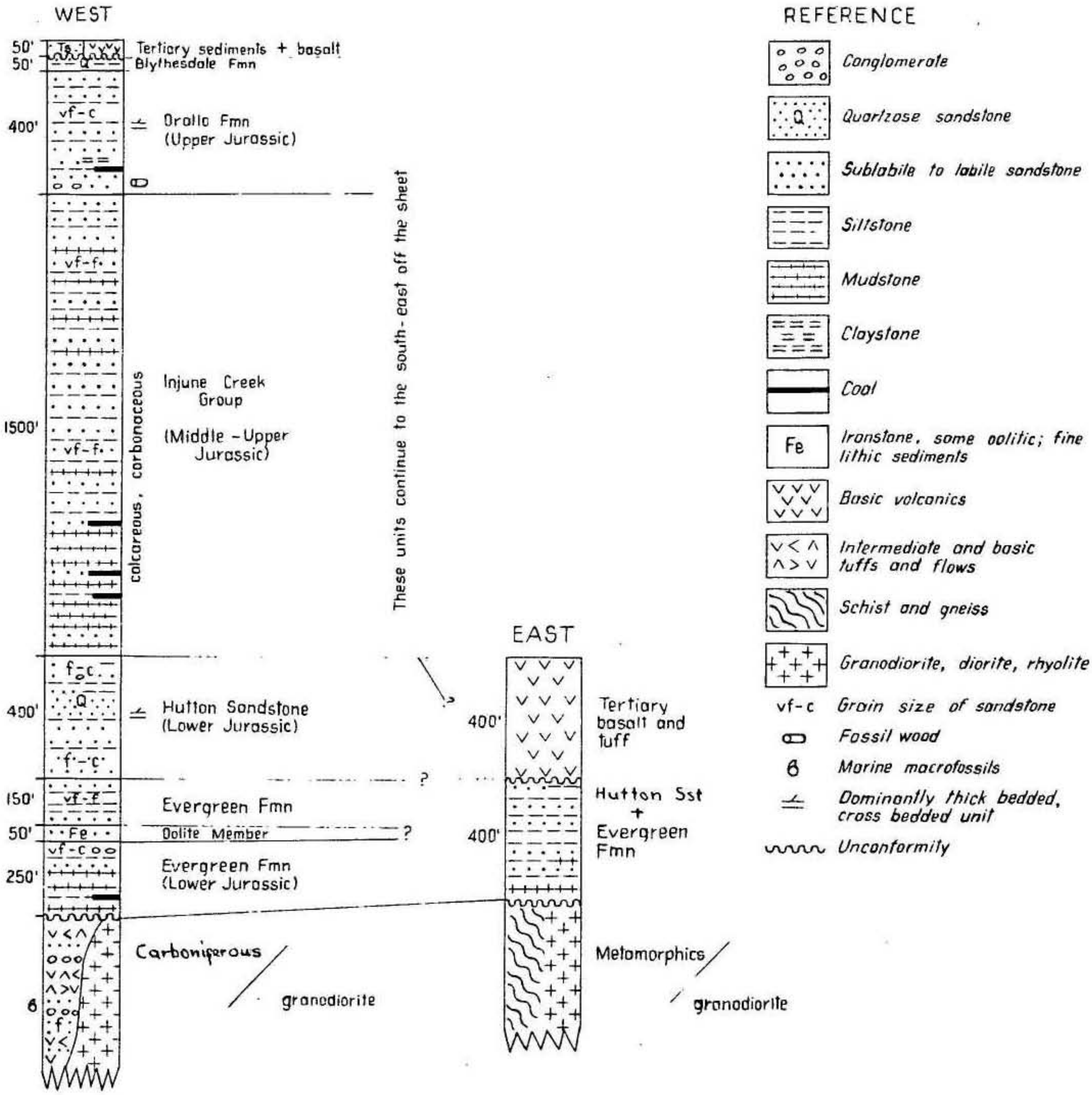
The Yarraman Complex consists of granite in the north and grades southward into, in turn, foliated granite, gneiss, schist and phyllite. In places the granite intrudes the Yarrol Basin sequence, which consists of strongly folded Carboniferous volcanics and sediments, and is marine in part. The Auburn Complex includes Carboniferous and Permian plutonics - those in this area are of unknown age.

The overall setting in the platform area is comparable with that on the Roma Shelf (see Exon et al., 1967). In both areas the basement complex is overlain by a Mesozoic succession of "layer-cake" units, the oldest in most areas being the Lower Jurassic Precipice Sandstone, which is overlapped by the Evergreen Formation; younger units are not preserved overlapping the Evergreen Formation. The

COMPOSITE STRATIGRAPHIC COLUMNS

CHINCHILLA SHEET

showing average thicknesses



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To accompany Record 1968/53

Mesozoic units are essentially freshwater sediments apart from the marine Lower Cretaceous Wallumbilla Formation.

Important points which came out of the mapping of the Jurassic and Cretaceous units in particular as compared with the Roma-Injune area to the west (which includes the type areas of most of these units), are:

(1) The Quartzose Precipice Sandstone crops out extensively in the Roma-Injune area, and around the Mimosa Syncline as far as the Cracow area, where it pinches out against the Camboon Andesite. It is present in much of the subsurface in the Chinchilla Sheet area, but does not crop out.

(2) The Evergreen Formation in the Roma-Injune area, in outcrop and the subsurface, is dominantly a silty unit. Near the top are the quartzose Boxvale Sandstone Member and the overlying oolitic Westgrove Ironstone Member. The Boxvale Sandstone Member is confined to the western side of the Mimosa Syncline and the Westgrove Ironstone Member may also be. There is an oolitic ironstone member on the eastern side of the syncline at much the same horizon, but the two rock bodies have not been shown to connect across the syncline (there is a wide gap in outcrop).

(3) Eastwards from the Mimosa Syncline the Evergreen Formation steadily becomes sandier. The sandstone is labile, varies from fine grained to coarse and pebbly, and is derived from the outcropping granites and Carboniferous volcanics and sediments. Basinwards (west and south) the formation becomes finer, and oil wells record a predominantly silty Evergreen Formation.

(4) In outcrop the Evergreen Formation consists of a sandy and silty lower sequence, varying from thickly crossbedded to well bedded, the overlying oolitic ironstone member, and an upper silty, thinly well-bedded sequence; these can be traced only as far east as the "Yarrol Thrust". Beyond these the sequence is not divisible, being a homogeneous mixture of sublabile and labile sandstone, siltstone and mudstone, of highly variable bedding characteristics; the oolitic ironstone member is absent, but spore determinations suggest that deposition occurred throughout Evergreen times.

(5) The generally quartzose Hutton Sandstone of the west gradually becomes more labile eastwards. On eastern Chinchilla Sheet it consists largely of variably bedded sublabile sandstone with lesser siltstone and mudstone.

(6) In the Bell area, where equivalents of the Evergreen Formation and the Hutton Sandstone overlie the Yarraman Complex, both (see above) are very similar, with sandstone, siltstone and lesser mudstone. Although the Hutton Sandstone is still slightly cleaner and more sandy than the Evergreen Formation, they cannot be separated by regional mapping techniques, especially with the abundant basalt cover.

(7) Our conclusions as to the relationship of the Evergreen Hutton sequence with the Marburg Formation (McTaggart, 1963b) of the Ipswich Basin, are essentially the same as those of McTaggart (1963a), who based his ideas on reconnaissance mapping in both basins and a summary of earlier work. He believed that the Helidon Sandstone was equivalent to the Precipice Sandstone and that neither was present on the Chinchilla Sheet. West of the "Yarrol Thrust" he mapped the oolitic ironstone member and the lower part of the Evergreen Formation together as the "Evergreen Shale". The remainder of the Evergreen Formation and the Hutton Sandstone formed his "Hutton Sandstone". On his accompanying map he showed the top of the Evergreen Formation as mapped herein as "Top of Lower Marburg type sandstone". East of the thrust he mapped Evergreen plus Hutton as Marburg Formation.

He concluded that the 600 foot thick lower part of the Marburg Formation of the Lockyer Valley (see McTaggart, 1963b), which consists of calcareous lithic sandstone, with interbedded shale, thin coal seams, siliceous sandstone and fossil wood conglomerate, was equivalent to our Evergreen Formation (average 500 feet). The upper part of the Marburg Formation of the Lockyer Valley (Heifer Creek Formation - McTaggart, 1963b), which consists of 700 feet of massive brown lithic to quartzose sandstone with interbeds of shale, was equated with our Hutton Sandstone (average 800 feet).

This correlation is complicated by the difficulty of separating the two units in the Bell area, and remains tentative. As Casey, Gray and Reiser (1968), who visited both areas at the conclusion of our mapping, have said in discussing the correlation "the distances involved between outcrops are too great (80 miles in this field study) for this to be more than a theory ... systematic mapping in the area between Bell and Toowoomba is necessary before the relationship of the older Jurassic units of the two Basins can be established firmly".

Even were the correlation proven it is apparent that the separate nomenclatures should be maintained for the two basins, in view of the atypical sediments in the Bell area between the basins.

(8) The Injune Creek Group in the Roma area consists of two formations of andesitic provenance - the lower muddy Birkhead Formation and the upper silty Westbourne Formation according to Exon et al. (1967). The upper part of the Birkhead Formation was the Springbok Sandstone Member, which Power and Devine (1968) have just raised to formation status. East of Roma the Westbourne Formation is replaced by sandstones which Power and Devine (op. cit.) assign to the Springbok Sandstone. Although the Birkhead Formation and Springbok Sandstone are separable in the subsurface they are not mappable on the surface east of Roma and we have (Exon et al., 1967) used the name Injune Creek Group for the whole interval. This situation persists in most of the Chinchilla Sheet (but the Birkhead Formation becomes more sandy eastwards) and the thickness of the group accords well with that in the Roma area.

(9) The fluviatile quartzose Gubberamunda Sandstone of the Roma area thins and becomes coarser and more labile in outcrop eastwards, until it is no longer recognizable near the eastern edge of the Roma Sheet. In the Chinchilla Sheet area it is present in the subsurface in some wells. In outcrop a conglomeratic labile sandstone sequence developed at the base of the Orallo Formation in the west may or may not be equivalent to the Gubberamunda Sandstone.

(10) The Orallo Formation is very similar to that in the Roma area, although somewhat thicker. It consists largely of labile sandstone and siltstone of andesitic provenance, with some bentonitic clay.

(11) The Blythesdale Formation crops out very poorly in the Chinchilla Sheet area, and could not be subdivided into members. In the Roma area there are four members (Day, 1964). The basal Mooga

Sandstone Member could be traced eastwards across the Roma Sheet (Exon et al., 1967) but the overlying freshwater Kingull Member and Nullawurt Sandstone Member lithologies gave way to those of the marine Minmi Member. Thus in eastern Roma Sheet only the Mooga Sandstone Member and the Minmi Member were mapped. These subdivisions may exist in this area but would be demonstrable only in the subsurface.

(12) The marine Wallumbilla Formation crops out very poorly in the Chinchilla Sheet area, and is heavily weathered. Presumably the muddy Doncaster Member and the silty overlying Coreena Member of the Roma area are present, but they could not be mapped.

Cainozoic sand, sandstone and alluvium is widespread in the Chinchilla Sheet area, and Tertiary volcanics are abundant in the south-east. Outcropping rock units of all ages were deeply weathered in early Tertiary times.

CARBONIFEROUS

Rocks of Carboniferous age are exposed in the northeast of this Sheet area as inliers west of McTaggart's (1963a) "Yarrol Thrust"* and as roof pendants in the granite further east. This sequence and its probable equivalents form the basement everywhere west of the thrust (see also subsurface units Carboniferous-Permian?). As the Carboniferous sequence is better exposed on Mundubbera Sheet to the north, we intend to defer naming of these rocks until that Sheet is mapped.

These resistant rocks generally form rounded hills with open eucalypt cover. The quality of outcrop varies, but is normally quite good. There are considerable variations in lithology from area to area but there are enough similarities to justify grouping these rocks together at this stage.

Some of the best exposures of Carboniferous rocks are around Wier Wier Homestead (425766) where very fine grained, thinly bedded tuff is interbedded with hard, medium to coarse grained labile arenite and massive rhyolite. The sandstone contains scattered, small, siliceous oolites. The thin and exceedingly regular bedding is very

*A.G. Kirkegaard (pers.comm.) believes that the Yarrol Thrust proper passes to the east of the Yarraman granites.

characteristic. Even small-scale cross-stratification is rare.

The most extensive outcrop of these rocks is farther west, in the area drained by the headwaters of Allies Creek. As well as the oolite-bearing sandstone, and the fine tuff and rhyolite, there is fine sandy limestone with marine fossils (SB1226 SB869 - late map correction) recrystallized limestone with scattered marine fossils, siltstone and minor breccia.

The bedded sequence of basalt, rhyolite, coarse and fine grained acid pyroclastics, and very fine grained, laminated feldspathic arenite, cropping out farther east on the hills around Manar Homestead (443767) is correlated with the sequence at Wier Wier Homestead, on the basis of lithology and bedding characteristics.

In the syncline (392768) northwest of Marian Vale Homestead there is a similar sequence consisting largely of well-bedded, laminated to thin-bedded, tuffaceous hard, bluish-grey to greenish-grey siltstone, and lesser lenses and thick beds of lithic sandstone. Mud-clasts, slumping and pyrite occur in some beds. Medium to thick-bedded basic flows and tuffs are also common. There is a strongly developed joint system trending west of north, and basic to acid sills and dykes are common. In a sequence of tuffaceous lithic and calcareous sandstones in the northeast (SB333) there is a calcarenite lens containing marine fossils - mainly crinoid ossicles and a few solitary corals.

In the area around Cadarga Stock Office (396757) to the south, the sequence is very varied. Unfortunately, bedding dips (generally steep to the southeast or fairly flat) are confined to a few areas, and hence the stratigraphy of what looks like a complexly folded sequence is poorly known. The tough, grey, thinly bedded tuffs, tuffaceous siltstone and lithic sandstone of other areas are still widespread. In places there is green phyllitic material which is probably a sheared, weathered variant of the above. There are also excellent exposures of completely unbedded, tough, grey, tuffaceous siltstone and fine grained tuffs, some of which are porphyritic in feldspar.

Around Cadarga Stock Office there is a sequence of thick-bedded to massive polymictic conglomerates. These contain rounded pebbles and cobbles of porphyry, with lesser cherty pebbles and, in places, a few quartz pebbles, set in a volcanic sand matrix. Elsewhere in the Cadarga area there are similar pebbly sandstones. At a few places there are agglomerates consisting of very angular to subrounded pebbles and cobbles of acid to basic volcanics set in a fine, tough matrix; in this material there are a few blocks of granite, and one limestone cobble has been seen.

East of the Stock Office (i.e.39757570), topographically below typical tuffs, tuffaceous sediments and conglomerates, there is a large body of quartz-feldspar porphyry. In places this contains dark cherty xenoliths, in others a few rounded pebbles. It is probable that this is a welded tuff or ignimbrite laid down early in the sequence (see Appendix 1). The conglomerates to the west could be largely derived from this or similar porphyrys. The lack of quartz pebbles (quartz veins are common in the porphyry) is an important point which suggests the veins were intruded after erosion of the porphyry and deposition of the conglomerate.

The whole Cadarga sequence is strongly jointed, with one prominent set striking north-northwest and dipping steeply. The whole sequence is cut by quartz veins which are larger in and near the main porphyry mass. Basic dykes (hornblende and pyroxene andesites) are quite common in the central part of the area.

There are three isolated outcrops of Carboniferous rocks further south. The first is just south of Silver Leaf Homestead (396753) where a hill of typical tuffs, flows, and lithic sandstone which is pebbly in part, rises through Evergreen Formation sediments. The unconformity is visible in the creek at the foot of the hill (Plate 2). The more easterly rocks are strongly sheared (strike northerly, dip steep). This area represents an exhumed Jurassic land surface.

The second outcrop is 13 miles to the south-east (413738). Here there are tough grey tuffaceous siltstones, greenschist, phyllitic mudstones and tough grey hornblende microdiorite. The bedding and shearing are roughly parallel (strike northerly, dip steep). A large quartz vein intrudes this sequence, and to the north there is a rise consisting almost entirely of vein quartz. This rise has been extensively dug over, perhaps for gold. The shearing may represent McTaggart's (1963a) "Yarrol Thrust" which separates, in a general way, the granite of the east from the Carboniferous of the west.

The third outcrop is a small one in gullies two miles to the northeast (416743). It consists of greenschist (shearing strikes 10°, dips 35°E) which abuts against a rise of acid porphyry to the east and is intruded by at least one vein. It is directly overlain by sediments of the Evergreen Formation.

These Carboniferous rocks are the oldest rocks in the area. They are intruded by the Yarraman granite in the Allies Creek, Wier Wier and Manar areas and show copper mineralization near the contact 3 miles east of Allies Creek Sawmill (see Economic Section). In the more westerly areas they are cut by quartz veins, and quartz-feldspar porphyry and basic dykes, which may represent deep-seated granites. They are unconformably overlain by basal breccias of the Evergreen Formation.

The environment of deposition varied from area to area and from time to time; acidic to basic explosive and effusive volcanism was ubiquitous. The thinly and exceedingly well bedded tuffaceous siltstones and lesser sandstones, which show little cross-stratification, and in places are graded, suggest quiet marine deposition below wave base. The calcarenite lenses, with their marine fossils including solitary corals, bryozoans and brachiopods, suggest shallow marine conditions, as do the oolitic sandstones. The massive conglomerates were probably derived from local highs and may have been freshwater deposits, at least in part.

The thickness of the unit is completely unknown owing to lack of structural knowledge, but on general considerations is almost certainly several thousand feet. Over 1000 feet of this sequence was penetrated in Condamine Canaan No.1.

Two collections of marine fossils have been made from the area. The first, from calcarenite at SB333 (393767), consists of 3 species of solitary corals, crinoid ossicles and a few brachiopod fragments (see Appendix 6) of Visean age. This fauna is tentatively equated with the Riverleigh Limestone fauna from Mundubbera Sheet to the north.

The second collection (SB869) comes from fine sandy limestone in the Allies Creek area (416763). It consists of brachiopods, bryozoa and crinoid stems. Of the brachiopod collection Dickins (pers. comm.) says "contains orthotetid and spiriferid brachiopods referrable to the Levipustula fauna of Middle Carboniferous age". The relationship between the beds containing the two faunas is not known.

Thus the age of the fossils collected varies from upper Lower Carboniferous to lower Upper Carboniferous. These are hardly representative of the unit as a whole, but are comparable with the Lower Carboniferous radiometric age for the basalt at the base of Phillips Kogan No.1 well to the south (Kyranis, 1963).

YARRAMAN IGNEOUS COMPLEX (PERMIAN?)

This complex, which is part of the Yarraman Block, lies in the eastern quarter of this Sheet. It is bounded on the west (see Fig. 9) by McTaggart's (1963a) "Yarrol Thrust" which trends somewhat east of north. In this Sheet its present outcrop area is about 500 square miles. However, east of the thrust "granite" is consistently met at depth in water bores (McTaggart, 1963a) and shallow drill holes (Olson, 1963). The combined area of outcrop and subcrop is probably about 1200 square miles. West of the thrust are folded volcanics and sediments of Carboniferous age.

In the outcrop area there is about 150 square miles of phyllites, schists, gneisses and foliated granodiorites in the south (Unit Mm), and about 350 square miles of massive granodiorite in the north (Unit Mg). In unit Mm the grade of metamorphism increases steadily northwards overall. In the south schists and some phyllites predominate; going northwards the grade increases through comparatively fine grained, strongly banded gneisses, which become less banded northwards, to foliated biotite granodiorite. Further north these give way to slightly banded biotite granodiorite with elongate biotite clots. The most noticeable change is from foliated granodiorite to equigranular granodiorite, and this change has been arbitrarily taken as the boundary between the dominantly metamorphic unit Mm and the unit Mg with its massive granodiorites.

The completely transitional boundary from Mm to Mg suggests a very close connection between them; we have the classical transition from metasediments to igneous rocks. Here we must say that we spent only about 30 geologist days on the whole of this complex. This is hardly an adequate basis on which to evaluate the various possibilities of relationships within the complex (see Turner and Verhoogen, 1960), Chapters 12, 23 and 24 for full discussion of possibilities).

Is this complex the result of granitization, with the granites of the north being the ultimate result of steadily increasing grade of metamorphism and/or metasomatism? Or are the granites intrusive into a metamorphic terrain, with metasomatism from granitic "juices" forming foliated granodiorites nearest the contact, gneisses beyond, and schists beyond that? We do not pretend to know the answer to this problem.

What we do know is that in most places, especially along the main area of contact in the north, there is a complete transition from Mg to Mm as outlined earlier; however around the small granite bodies of the south the contact is very sharp. On the Cooinda Homestead - Kingaroy road, half a mile east of the Sheet boundary, phyllites intermingle with weathered granodiorite at the contact. In a gravel pit (44656955) at the foot of a hill half a mile north of Sqrum Homestead immediately east of the road running north from Sqrum Homestead, schist and massive granite are in sharp contact. The schistosity is abruptly truncated by the granite; no contact metamorphic effects of any significance are visible.

Whether or not the main mass of the granite is a product of granitization, or a simple intrusive which has altered the surrounding metamorphics, it is quite apparent that parts of it were mobilized at a late stage and intruded the surrounding metamorphics. Most of these late intrusive bodies were probably fairly small and cooled rapidly, leaving sharp contacts. For example, that near Sqrum Homestead on its northern side consists largely of porphyry, with abundant quartz veins.

Late stage differentiates gave rise to rhyolite, porphyry and quartz dykes which cut both Mg and Mm. In Mm these are most common near the contacts with Mg.

The age of the complex is not definitely known. As, in this area, it intrudes the early Upper Carboniferous and is unconformably overlain by the Lower Jurassic, it is probably either Permian or Triassic. McTaggart (1963a) states "The Boyne River Granite (Mg) of the Yarraman Block was emplaced in the late Permian or early Triassic, since it intrudes ?Permian at Yarraman and is unconformably overlain by Triassic Tarong Beds". The common Permian K/Ar ages from the granites to the north suggest that the Boyne River granite may also be Permian in age. Several samples from the Boyne River granite, and one of a foliated biotite granodiorite (Mm), have been submitted for radiometric age determination.

Schists and Gneisses (Mm)

The schists, phyllites, gneisses and foliated granodiorites which crop out in the central east of the Sheet are part of the Yarraman Block. They form rounded hills in strongly dissected hill country. They naturally support a dense eucalypt forest on their sandy soils, but most of this is now cleared. The best outcrops are in the valley bottoms, on the ridges, and on steep slopes; overall, outcrop is not particularly good.

Representative rock types are described in Appendix 1. There are no unusual rock types in the suite. The contact with the Boyne River Granite is generally gradational, but that with the smaller granite bodies (Mg) within the unit Mm is sharp.

The schistosity within the schists and gneisses is often simple, but in places there are several sets of planes intersecting. The dominant schistosity where measurable at each outcrop visited is plotted on the geological map. It can be seen that the strike of the schistosity is generally northerly with the dip varying greatly. With the amount of work done it is plainly impossible to differentiate the type of schistosity (whether shear or compression). However, the northerly orientation of the foliation, especially when considered in conjunction with the similar orientation of the jointing in the Carboniferous sequence, and of the "Yarrol Thrust" (McTaggart, 1963a) which bounds the Yarraman Block to the west, strongly suggests east-west compressive forces.

The metamorphics are unconformably overlain by the Lower Jurassic Evergreen Formation and basalts of Tertiary age. The dips of up to 20° in the Evergreen Formation (which is virtually flat lying elsewhere in the Sheet area) near Pine View Homestead (445697), where it immediately overlies Mm, suggests that movement in the metamorphics continued at least well into the Jurassic.

Boyne River Granite (Mg)

This name was used for the granites around the Boyne River by McTaggart (1963a). It is here used to cover all the granites on Chinchilla Sheet east of McTaggart's "Yarrol Thrust". These crop out over an area of about 350 square miles in the northeast corner of the Sheet, and in several small outcrops further south. On the airphotographs they are virtually indistinguishable from unit Mm, as they form rolling hills which are largely cleared. One distinguishing characteristic is the abundance of small tree-covered buttes which represent deeply weathered granite or granite wash (Czg). Outcrop varies from poor to quite good, and is certainly better than in Mm. Large tors are plentiful on hill crests.

Although the unit is composed of a number of intrusive rock types no subunits have been defined within it. The various lithologies are described in Appendix 1. The most common rock type is hornblende-biotite granite grading to biotite granite; in some places it has enough oligoclase and albite to be classified as granodiorite. These granites range from fine to exceedingly coarse grained, with feldspar crystals up to 3 inches long, and there are rare pegmatite dykes. These rocks are intruded by fine grained acid dykes, particularly in the northeast. The dyke rocks are commonly amygdaloidal (spherulitic chalcedony) with vertical banding. Porphyry dykes are also common, but basic dykes are rare.

Southwest of Wier Wier Homestead (425766) the most common rock type is pinkish leucogranite with few mafic minerals. Further east the most common rock types, leucocratic granite and microgranite, also lack mafic minerals (apart from chlorite).

In the northeast there are well developed joint patterns striking northwest and northeast. In the westerly outcrops, to the east of Allies Creek Sawmill, there are strongly developed joints trending in a northerly direction, which are probably related to the "Yarrol Thrust". The swarms of vertical acid dykes in the northeast corner, which trend north-northwest overall, have probably been intruded along joints.

The Boyne River granite, which is probably of Permian age, intrudes the Carboniferous sequence in the areas near Allies Creek and Wier Wier Homestead, and the various small Carboniferous outcrops near Manar Homestead are roof pendants in the granite.

It has introduced copper minerals (now malachite and azurite) into the rocks east of Allies Creek Sawmill where they were mined and the ore crushed, for a time (see Economic Section). East of Wier Wier Homestead, in a creek which runs out of the granite, the stream sediment has been successfully panned for tin.

<u>AUBURN GRANITE</u> (Mg)

The name Auburn Granite is long established for the great expanse of granite and granodiorite which runs north from this area almost as far as Thangool. Jensen (1926a) was the first to describe the plutonic rocks of the Auburn Range. He briefly listed the rock types seen and referred to the unit as the "Auburn Range Complex". Jensen et al. (1964) called the unit the Auburn Complex. In the Chinchilla area granite predominates and Auburn Granite is an appropriate name. In this area it crops out over only a few square miles in the central north. The biggest body forms a series of forested ridges north of Coondarra Homestead. West of these are several other very small granite bodies.

The main body on the Sheet, which has a north-northwest trending joint system, consists largely of fine to medium grained hornblende-biotite granite in the west, with some rhyolite. East of the road it is much more varied, with biotite granite varying from very fine to gneissose, and dykes of diorite, rhyolite and acid porphyry aligned parallel to the jointing. In the east, just west of the track north of Burnwood Homestead (360764), there are large tors of a massive hornblende diorite. This body is unconformably overlain by the Evergreen Formation.

Another tongue of granite extends down from the north about six miles further west. This lies on a north-northwest trending fault line (visible on the photos but not on the ground). The body forms a terraced ridge in a valley surrounded by deeply weathered Evergreen Formation which dips away gently on either side. The body consists entirely of heavily weathered pink granite with two feldspars and, in places, minor biotite. A prominent shear strikes 10° and dips steeply; it appears to have controlled the creek in the valley floor. The granite probably pre-dates the Evergreen Formation, but the contact is nowhere seen. There are no granitic fragments in the Evergreen Formation at this point, but the Evergreen is substantially above the granite body.

Three miles to the south of this body, on the same fault line, there is a small boss-like outcrop of granite porphyry containing some biotite in places. This is surrounded by exceedingly fine grained acid porphyry dyke rocks. No relationship with the Evergreen Formation is visible. It appears that granite was intruded along a line of weakness; later movement on that line has tilted the Evergreen Formation and provided the vent for the small basalt bodies (of probable Tertiary age) preserved in the vicinity. Near Warranna Homestead to the southwest (343761) there is a mound of granite boulders in the creek bank in alluvium. Although this is shown on the map, it is just possible that it has been carried in by humans for use in a creek crossing.

The Auburn granite in this area is pre-Evergreen Formation (i.e. Lower Jurassic), but no contacts with older rocks were seen. Further north (Mollan et al. in prep.), it has been dated by K/Ar radiometric work as Permian in age. It is similar petrologically to the Boyne River granite, on the other side of the Yarrol Basin graben structure.

JURASSIC-LOWER CRETACEOUS

Evergreen Formation

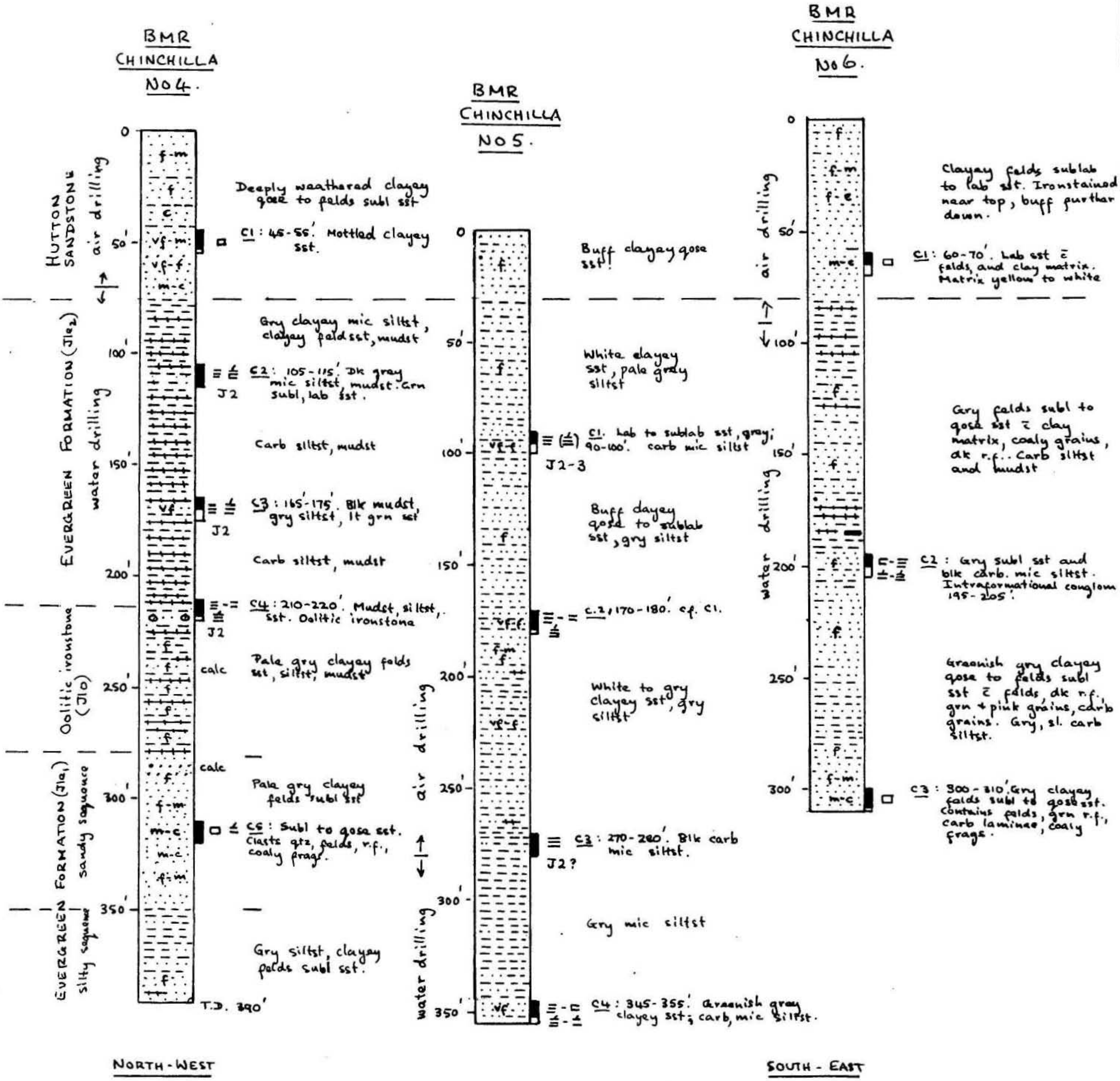
The name Evergreen Formation is an extended usage of the name "Evergreen Shales" of Whitehouse (1952) and includes all the Jurassic sediments between the Precipice Sandstone (where present) and the Hutton Sandstone. The type section, measured in northwestern Taroom Sheet area, was presented in Mollan, Exon and Forbes (1965), and will be published in Mollan, Forbes, Jensen, Exon and Gregory (in prep.).

Two members were differentiated on the western side of the Mimosa Syncline (Mollan et al., in prep.) - the quartzose Boxvale Sandstone Member, which varies greatly in thickness, and the overlying widespread pelletal and oolitic Westgrove Ironstone Member. On the eastern side of the Mimosa Syncline (this area) the Boxvale Sandstone Member is not present. There is a pelletal and oolitic ironstone member, but this cannot be traced into the Westgrove Ironstone Member, and hence is regarded as a separate unit, although it may well be an equivalent development on the other side of the syncline.

This oolitic ironstone member, which was mapped to the north around the eastern flank of the Mimosa Syncline by Jensen, Gregory and Forbes (1964) can be traced across the Chinchilla Sheet as far east as McTaggart's (1963a) "Yarrol Thrust". Thus in outcrop the western two-thirds of the Sheet the Evergreen is subdivisible into three - a lower arkosic part, the oolitic ironstone member, and an upper silty part. In the area of the Durong Plain (see Fig.1) west of the "Yarrol Thrust" (Fig.9), Pleistocene sediments sit directly on granites and no Evergreen sediments are preserved. East of the plain the oolitic ironstone member is not identifiable, (although a few pelletal beds have been found) and the formation is no longer divisible. This eastern facies of the Evergreen Formation is dominated by sandstone, which varies between lithic and quartzose.

The Evergreen forms quite good pastoral country where it is not too sandy or covered with sand scree from the Hutton Sandstone. Thus the area between and around Monogorilby School and Bawnduggie

LOWER JURASSIC SHALLOW DRILL HOLES



G56/A9/8

To accompany Record 1968/53

Homestead in the central north is used for intensive cattle raising, and related cropping. The clayey soils naturally support a brigalow vegetation, whereas the more sandy soils in the lower Evergreen support an open eucalypt cover.

The oolitic ironstone member is a strong scarp-former, and an overall very gentle dip to the south can be discerned on the airphotographs. Some sandstone beds elsewhere in the formation also form benches. The structural picture is complicated and confused by the old Tertiary land surface which is preserved as ferruginized or leached mesas and buttes.

The arkosic lower Evergreen has been derived largely from the underlying granites to the north and east; in some areas there is additional debris from the Carboniferous sequence. It is thickest in the Yarrol Basin graben structure. Wherever the base of the unit is seen there is a coarse basal sandstone or breccia. Conditions varied from place to place and lateral and vertical accretion fluviatile deposits are interbedded with deltaic and possibly lacustrine sediments. The oolitic ironstone member marks a change to generally quiet conditions; it may possibly be marine. The Upper Evergreen Formation is generally silty and was probably laid down largely in backswamps and lakes; lateral accretion fluviatile deposits are still present in places.

This arkosic Evergreen Formation is atypical and is regarded as a basin marginal facies. Whether some of the basal sandstone of the Evergreen Formation in the marginal area is a time equivalent of the Precipice Sandstone in the basin is not known. Away from the margin, both in the subsurface in this area and north-westwards in outcrop in the Mundubbera area, the Evergreen Formation is dominantly silty. Even within the outcrop in this area (see Fig.4) the unit becomes coarser eastwards. The change from dominantly sandy on the Chinchilla Ridge in Condamine Canaan No.1 well, to dominantly silty and muddy further into the basin is well shown in Plates 10 and 11. It can be seen, though, that everywhere in the subsurface, as in outcrop, the Evergreen Formation is coarser lower in the sequence.

In outcrop the formation is about 700 feet thick in the west, up to 1300 feet thick in the Yarrol Basin graben, and perhaps 500 feet thick in the east. In the subsurface it is generally about 500 feet thick.

Fossils and age. The Evergreen Formation contains abundant plant debris. In this area White (1967) has identified plants from locality SB379 (447697) 1 mile southeast of Pine View Homestead as *Cladophlebis* sp. and *Brachyphyllum angustum* Walk. of Mesozoic age. Further determinations of Mesozoic plants from western Mundubbera Sheet to the north are listed in White (1964).

In general the most useful fossils from the Evergreen Formation are spores, pollen and microplankton. In the outcrop area a number of holes have been drilled in the sequence by Phillips Petroleum Co. (Olson, 1963), and by the B.M.R. for the present writers. Spores of Evans' (1966a) spore divisions J1 and J2 have been recovered. These are found in the stratigraphic intervals; basal Precipice Sandstone to base of Westgrove Ironstone Member, and Westgrove Ironstone Member into the Hutton Sandstone, respectively. Both are of Lower Jurassic age.

A palynological report was made on cuttings from the Phillips Petroleum Co. drilling by de Jersey and Paten (1963) - see Plate 9. All the assemblages were dominated by *Classopollis* and all except one contain gen. nov.A., a combination believed by de Jersey and Paten to be characteristic of the Evergreen Formation, which agrees with the present mapping. Samples F4 (70'-80') and C1 (30'-40') are believed to be of upper Evergreen age (Westgrove Ironstone Member and younger, i.e. J2, and sample G1 (40'-50') to be slightly younger (but still probably upper Evergreen). Samples F4, C1 and G1 all come from less than 100 feet below the oolitic ironstone member as mapped. This suggests that the oolitic ironstone in this area may be slightly younger than the Westgrove Ironstone Member of the west. The remainder of the samples are of Evergreen age (i.e. J1) and come from considerably deeper. A point of interest is that although some of the samples were well down in the Jurassic sequence, no Precipice Sandstone assemblages (i.e. J1 without gen.nov.A) were reported.

Logs of holes drilled during the present survey are presented in Figs. 4 and 5, and the palynology of some of the cores is discussed by Burger, in Appendix 2. Although Burger has attempted to distinguish unit J2 from J3, this does not seem convincing in these holes. The oolitic ironstone in core 4 in Chinchilla No.4 contains the acritarch Micrhystridium sp. which characterizes the Westgrove Ironstone Member (e.g. Paten, 1967). It is of interest that core 3 in Chinchilla No.5, which is perhaps 100 feet below the oolitic ironstone member on stratigraphic grounds, yields a J2 assemblage as did equivalent samples examined by de Jersey and Paten (1963) - see earlier.

Environment of deposition. This is discussed more fully in the various subsections following. Although the Evergreen Formation has frequently been regarded as a marine unit and the source of the hydrocarbons in the Jurassic sequence, there is little evidence of marine affinities (apart from in the thin oolitic ironstone member) in this area. The outcropping lower and upper Evergreen units, and the eastern facies of the formation, can be readily explained as freshwater deposits of fluviatile, deltaic and lacustrine type. Likewise the basinal development of the unit may easily be described as freshwater, of dominantly lacustrine and deltaic type.

We cannot say that the Evergreen Formation is not marine in part, but we have seen little evidence in favour of marine conditions.

Subunits within the Evergreen Formation. In the following pages are discussed -

(a) The western marginal facies in which the oolitic ironstone member is recognizable. This facies, although it contains labile sandstone of local derivation, also contains abundant siltstone and mudstone. It is subdivided into

(i) Lower Evergreen Formation (Jle_1)

(ii) Oolitic ironstone member (Jlo)

(iii) Upper Evergreen Formation (Jle_2)

(b) The eastern facies (Jle_e) which is equivalent to all, or most, of the Evergreen Formation, but does not contain the oolitic ironstone member. It is dominated by labile arenites of local origin.

(c) The basinal facies which is dominantly siltstone and mudstone and has been recognized only in the west and south in the subsurface.

Western marginal facies - Lower Evergreen (Jle_1)

This unit is only recognizable in the central north of the Chinchilla Sheet area, west of the "Yarrol Thrust". It swings around the Auburn Granite and trends north-northwesterly across Mundubbera Sheet. It has been mapped as far west as the Nebine Ridge.

With the exceedingly shallow dips involved, and the numerous highs of Carboniferous sediments, it is difficult to build up a reliable picture of the stratigraphy of this unit. However, in the central part of the area a typical sequence from the oolitic ironstone member downwards is:

(1) 100 feet of fine to very coarse grained to pebbly labile sandstone. This typically contains (see Appendix 1) both potash feldspar and plagioclase derived from the granites, and sedimentary and volcanic clasts derived from the Carboniferous sequence. There is generally considerable muscovite and some zircon, and the whole is set in abundant clay matrix. This sandstone is normally thickly bedded and crossbedded, and weathers to form rounded outcrops.

(2) Below the uppermost sandstone is several hundred feet of well bedded, generally laminated to medium-bedded, mudstone, siltstone and fine grained sublabile to labile sandstone. This varies from the unresistant siltstone and mudstone (Photoplate 1a) to tough fine grained feldspathic sandstone and siltstone (Photoplate 1b). The type of sequence shown in Photoplate 1b (389757) is very probably of deltaic origin, with low-angled crossbeds and an abundance of plant debris. Elsewhere in this sequence ripple marks are a common feature.

a. Typical unresistant Evergreen Formation siltstone and mudstone in the west (M.R. 354 762)

b. More resistant Evergreen Formation of the eastern type. About 20' of fine sandstone and siltstone (M.R. 389 757)

(3) Below the well-bedded sequence the unit is virtually unknown, although good water supplies in places suggest some fairly clean sandstone beds.

Contacts with the underlying units have been seen at a number of localities. Unit Jle_1 always rests on the underlying Palaeozoic rocks. Nowhere are overlapping younger sediments preserved. It laps up against and unconformably overlies both the granite bodies and the Carboniferous sequence.

Where it rests on the granite an unbedded "granite wash" may develop, as at GR447695 (Photoplate 3b). Above this there are more normal arkosic sediments, generally thickly bedded and crossbedded, and in many beds containing quartz pebbles and clay clasts.

Where Jle_1 rests on the Carboniferous sequence its nature depends on the rock-types in that sequence. Where it overlies fissile phyllites, or well bedded cherts, a basal breccia is commonly developed. One such exposure is north of Marian Vale Homestead, in a gully at GR393769. Typical thinly bedded cherts dip at about 30°. Above them is 10 feet of flat-lying chert breccia, with a fairly level contact. Above this is 30 feet of surprisingly clean, fine grained quartzose sandstone which is thin to medium-bedded, and quite reminiscent of the Boxvale Sandstone Member. Above this, alternating sequences of labile and quartzose sandstone are found. These quartzose sandstone beds appear to be restricted to the northernmost part of the Sheet, and are not particularly abundant even there.

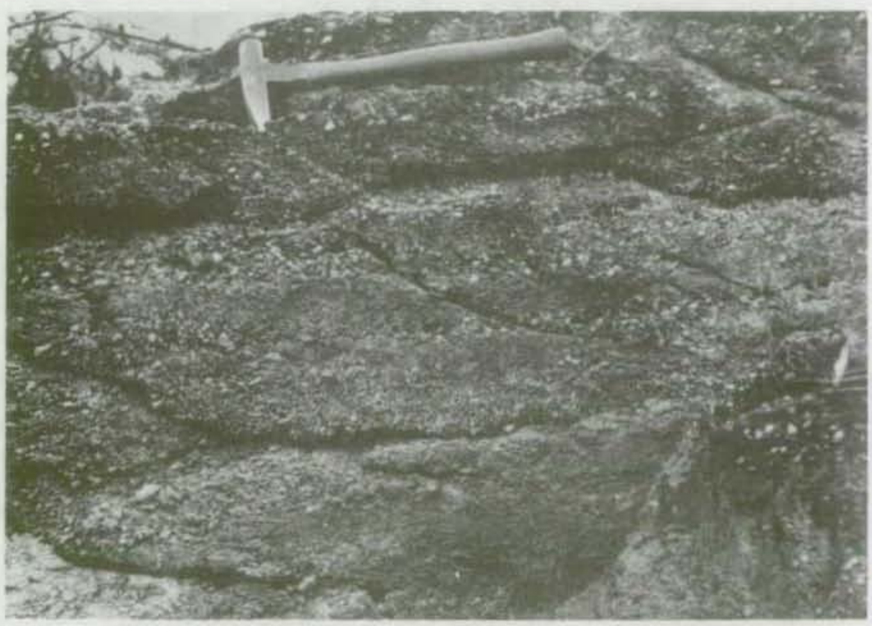
Immediately opposite the yards at Cadarga dip in erosion gullies at GR396756 the basal Evergreen Formation is well exposed. The contact is not seen but nearby are several Carboniferous rock types which form a scree at the present day. The Evergreen outcrops consist largely of siltstone, mudstone, and feldspathic sandstone, and contain much plant debris and feldspathic sandstone. However, there are several beds of pebbly mudstone (diamictite) grading to polymictic conglomerate; clasts are largely angular chert, sandstone and volcanic fragments which match the modern scree on the Carboniferous. It is probable that this was an area of quiet fluviatile sedimentation at the foot of a Carboniferous slope. Periodically a slight tremor or deluge of rain probably caused a mudflow involving both fines and pebbles, which spread out across the area of sedimentation. Interestingly, a quartzose grit bed (a rather rare phenomenon in this unit) overlies one of these mudflows.

Another particularly interesting contact is at GR396753, 2 miles to the south. There a ridge of sheared Carboniferous sediments and volcanics rises above a plain of Evergreen sediments. At the foot of the hill the unconformity between strongly sheared ?tuff and a few feet of fine clayey (?feldspathic) sandstone is visible (Photoplate 2a). Above this is about five feet of pebbly sandstone, grit and conglomerate, consisting largely of angular quartz, with lesser chert and quartzite (Photoplate 2b) and very similar to the grit at Cadarga dip (see above).

The general depositional picture in this part of the Evergreen Formation is fairly clear. During the Triassic and earliest Jurassic this was an erosional area. However, during that time, the low areas to the south and west had been filling with sediments, most units overlapping earlier ones up the basement highs. (It is likely that this overlapping continued at least until the period of renewed basement movement in the Tertiary, but the younger sediments have since been eroded). This overlapping process probably explains why the Precipice Sandstone is not exposed in this area, although it is present at lower levels in the south.

The granite and the Carboniferous sequence weathered to give gravel, sand, or mud. Streams on the flanks of the highs eroded this material and transported it southwestwards overall, or into the Yarrol Basin Graben. Once gradients diminished these streams meandered. They deposited coarse material as point bars and channel deposits near the source, and the transported sediment became finer and cleaner down the stream course. Finer overbank deposits were widespread and these also became finer away from the source. In some areas streams were impounded and lakes formed, and considerable thicknesses of fine sediment were laid down. Deltas encroached on these lakes. In the

a. Unconformity between sheared, leached, very fine grained ?tuff of probable Carboniferous age and fine grained sandstone of the Evergreen Formation.
(M.R. 396, 753)



b. Cross-bedded thick-bedded conglomerate consisting of angular quartz clasts in sublabile sandstone matrix. Low in Evergreen Formation; 10' above photo a.

west gradients were lower and the sequence finer. A last burst of high energy fluviatile deposition saw the close of lower Evergreen deposition. By that time the whole area was rather flat with all the hollows filled with sediment.

The thickness of the lower Evergreen varies greatly. In the west it is probably around 500 feet; near Bawnduggie Homestead GR383750 in bore 14506, it is 680 feet thick; in the Yarrol Basin graben it is probably up to 1000 feet thick. It thins basinwards. The formation provides some subartesian water, but supplies are limited and salty.

Western marginal facies - Oolitic ironstone (Jlo)

This unit overlies the lower Evergreen Formation in the central north of the area. It has not been seen east of the "Yarrol Thrust" in this area, although there are lithologically similar oolitic ironstone beds of palynologically equivalent age in the Ipswich Basin (R.J. Paten, pers.comm.). In outcrop it has been traced as far north-west as the Leichhardt Highway on the Taroom/Mundubbera Sheet boundary. In the subsurface it is present in U.K.A. Wandoan No.1 (Roma Sheet) and U.K.A. Burunga No.1 wells (Mundubbera Sheet) on the eastern side of the Mimosa Syncline (see Jensen, Gregory and Forbes, 1964). In the Chinchilla Sheet area the best exposures are at the top of the scarp which the unit forms. Usually only the upper 20 or so feet in this scarp consist of the oolitic ironstone member, but oolitic ironstone is found well back on the overlying platform.

The member characteristically develops red silty soil. Outcrop is better overall than for the remainder of the Evergreen Formation. One easily accessible good exposure is at GR364756 on the road (and in the adjacent creek) to Wambalano Homestead.

One problem is whether the oolitic ironstone member and the Westgrove Ironstone Member of the western side of the syncline are the same body. In outcrop there is a gap of nearly 50 miles between the two units, in the axial region of the Mimosa Syncline. In the subsurface there is a gap between wells of the same order, as no one has drilled in the axial part of the Mimosa Syncline. Although oolitic ironstone is present at much the same level in U.K.A. Wandoan No.1 in the east, and AAO Meeleebee No.1 in the west, there could well be a gap in the subcrop corresponding to that in the outcrop. For the present the name Westgrove Ironstone Member must be restricted to the west, and the informal name "oolitic ironstone member" used in the east.

The member is characterized by the presence of oolitic and pelletal ironstone beds of varying thickness. In an average 50 feet of section there would be one or two beds up to 3 feet thick and several thinner beds. The thicker beds are continuous over the width of an outcrop. Normally they are brown and limonitic, but here and there the pellets and oolites (which vary between 0.5 and 2.5 mm in diameter) are pale green or creamish in colour, and in places the whole outcrop has a greenish hue. The oolites themselves are round or ovoid (long axis parallel to the bedding) and some show definite concentric structure with colour banding. The boundaries between oolitic and non-oolitic beds are generally sharp.

Other common rock types include concretionary ironstone (oolitic in part), friable greenish oolitic sandstone, fine grained lithic sandstone, and siltstone and mudstone. Colours vary from greenish-yellow through yellow to brown as the affect of weathering increases and iron migrates. In a few places in the east medium to coarse grained feldspathic sandstone with quartz granules appears between oolitic horizons. This increase in arenite grainsize eastwards corresponds with the situation throughout the Evergreen Formation.

The member is exceedingly well bedded, with the coarser rock-types medium to thickly bedded and finer rock types more thinly bedded. Cross-laminae, ripple marks and mudcracks occur in some beds, especially in the area northwest of Glenroy Homestead (e.g. gullies at 383764), but these features are not common.

Thin section examination of the oolitic ironstone beds (Appendix 1) shows that in outcrop they are generally limonitic throughout. However a section from core 4 in BMR Chinchilla No.4 well, at 217 feet, shows that the oolites themselves are composed of an iron mineral (possibly siderite in this slide); whereas the matrix of the rock is calcite. Probably the original composition of both oolites and matrix varied with differences in chemical and physical environment. Bastian (see Jensen et al., 1964) identified chamosite by x-ray methods from oolitic rock in cores in BMR No.29 (Mundubbera).

The environment of deposition of this unit is discussed in great detail in Jensen et al. (1964) and in Mollan, Forbes, Jensen, Exon and Gregory (in prep.).

It is evident from the nature of the bedding that the deposit was laid down in quiet, generally standing water - in lacustrine or quiet oceanic conditions. The presence of some mudcracks suggests periodic exposure of at least some of the sequence. When the widespread nature (Surat and Ipswich Basins) and narrow vertical extent (less than 90 feet everywhere) of these oolitic beds is considered, and the presence of oolites (formed in marine conditions above wave base?) and acritarch swarms is noted, the most obvious conclusion is that these beds represent a rapid marine transgression in the otherwise dominantly freshwater Jurassic sequence. The absence of a marine macrofauna may be explained in terms of a rapid marine transgression and regression in a restricted basin not giving time for a fauna to be introduced; or perhaps by conditions inimical to sophisticated animal life. One mytiloid pelecypod has been found in the unit on Mundubbera Sheet (Jensen et al., 1964), which suggests an estuarine environment for that bed at that time.

However, oolites are abundant in English bog iron ores of freshwater origin, and even chamosite is not necessarily a marine indicator. Thus the environment can be said to be probably marine, but not conclusively.

The alternation of chemical precipitation of iron minerals with clastic sedimentation suggests considerable variation in rainfall, and the generally fine grain size suggests low relief, in the source areas. Whether the origin of the unit is marine or not, it is apparent that special conditions, of very widespread extent, prevailed during oolite deposition. Although these may have been of a transgressive/regressive nature, it is probable that the oolite member approximates a time line.

Thickness in the Mundubbera area is generally less than 30 feet according to barometric levelling by Jensen et al. (1964) and drilling by Urquhart (1962). This accords well with the thickness in the western part of this area. However, eastwards the unit thickens to 60 or more feet in places (e.g. on track at 402,740); some of the most abundantly oolitic exposures are in this area (e.g. scarp at 417752).

This thickening towards the "Yarrol Thrust", beyond which the oolite member is not found, suggests that that was not the depositional margin. Probably later movement, up to the east, caused the erosion of the member. A connection with the Ipswich Basin during deposition is strongly suggested.

Western marginal facies - Upper Evergreen (Jle_2)

This unit overlies the oolitic ironstone member throughout the central north of the area. It persists north-northwestwards across the Mundubbera Sheet area to the vicinity of the Taroom-Cracow road (i.e. less far than the oolitic ironstone member). There is a similar unit above the Westgrove Ironstone Member west of the Mimosa Syncline.

This dominantly silty unit does not crop out particularly well. However, in places where the basal Hutton Sandstone forms a strong scarp (e.g. Round Mountain, GR396725) it is quite well exposed. It is 135 feet thick in BMR Chinchilla No.4, in the west, but probably thickens to about 200 feet in the east.

The commonest outcropping rock types are white, very fine to medium grained feldspathic sublabile to feldspathic sandstone, and siltstone. The sandstone is clayey, and appears more quartzose in handspecimen than in thin section. It generally contains some dark rock fragments and muscovite, and sometimes a little magnetite or quartz. Clay clasts, worm burrows, and plant debris are abundant in some beds. The finer grained rocks are generally thin to medium-bedded and very well bedded, with ripple marks and low-angled crossbeds quite common. The coarser grained rocks which are not very abundant are commonly thickly bedded and show high-angled crossbeds.

The siltstone is grey when fresh but weathers to white. It is gradational into mudstone and sandstone, is generally clayey, and contains muscovite. Plant remains, roots in situ and leaves in bedding planes, are common. The siltstone is generally well bedded, varying from laminated to thinly bedded. Crosslamination and ripple marks are present in some beds. In places the siltstone is strongly ferruginized, especially between sandstones, and one sample of probable ferruginized cone-in-cone limestone was seen. This ferruginization is a weathering feature, and little iron is seen in the unit in the subsurface. The shallow drilling showed that the unit is finer grained in the west, being largely siltstone and mudstone in BMR Chinchilla No. 4, but sandstone and siltstone in BMR Chinchilla No.5 (see Fig.4).

One exceptional outcrop is on a hill east of the Chinchilla/Cadarga road, GR401745. Here the higher energy conditions of the lower Evergreen have recurred in post-oolite times. Apart from typical upper Evergreen lithologies there are several beds of medium to very thickly bedded, fine to very coarse grained arkosic sandstone with strongly developed high-angled crossbedding. Ferruginized siltstone separates these beds. At the top of 30 feet of this material is a grit grading to pebbly sandstone which contains quartz, feldspar and chert pebbles, and mudclasts.

In general it can be said of the upper Evergreen Formation that it was deposited by fairly low-energy streams, with backswamp material widely preserved. In places lakes and deltas may have formed.

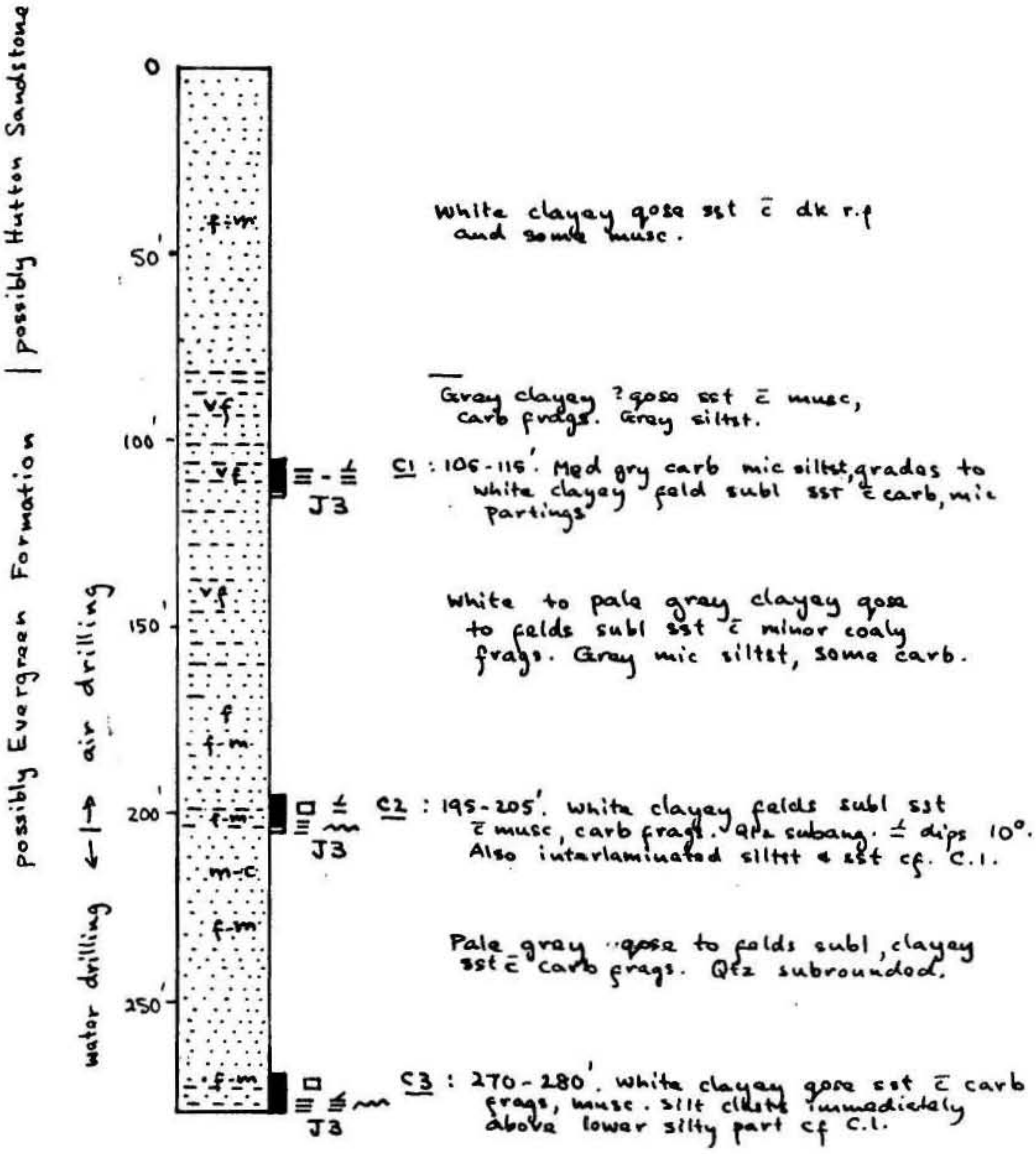
The change to the overlying Hutton Sandstone is quite sharp, with thinly well-bedded siltstone and sandstone giving way to thickly bedded, crossbedded sandstone. Unfortunately, leaching obscures the more labile character of the upper Evergreen Formation in outcrop. Also there is a similar silty level in the Hutton Sandstone above the basal sands. Add to this the widespread sand cover, and it becomes very difficult to map the base of the Hutton Sandstone. This was done by methodical tracing of the contact from the west, where it is more obvious, to the east.

Eastern facies (Jle_e)

East of the "Yarrol Thrust", where Evergreen sediments re-appear east of the Durong plain, the oolitic ironstone member is no longer mappable. Although a few pelletal ironstone bands have been seen in the far east near Fairfield Homestead (444701) about 250 feet above the base of the Evergreen section, these are atypical of the oolitic ironstone member proper, with very small and irregular pellets. It is probable that this area was a relatively high one in Evergreen times with stream deposition predominating.

The outcropping eastern facies Evergreen Formation consists of interbedded sandstone and siltstone, with local conglomerate lenses, and minor mudstone. The sandstone is largely fine to medium grained, well-bedded and thin to medium-bedded, with low-angled crossbedding and ripple marks in some beds. However, thick bedded, less well sorted, coarser grained sandstone, with high-angled crossbeds generally with a component to the west where measured - in the north) are also common. These grade into grits and pebbly sandstone. All the sandstones examined in thin section (see Appendix 1) are lithic to lithic sub-labile types. However, in outcrop they may appear more quartzose, and some appear to be true quartzose sandstone; this is certainly due to heavy leaching in some cases, but some true clayey quartzose sandstones do exist. The most common sandstone appears to be sublabile and very clayey with feldspar, cherty rock fragments, muscovite and abundant clay matrix. Fresher sandstones generally appear labile, and more leached ones quartzose. Some beds are calcareous, and many have the appearance of leached, originally calcareous, beds. Plant remains are common in some beds. In thin section quartz is dominant, with abundant cherty rock fragments, some of which are acid volcanics, quartzite, a little feldspar (potash or plagioclase), muscovite or biotite, and in some specimens, zircon and iron ore. Clay matrix is very abundant.

DRILL HOLE BMR CHINCHILLA No 7
EASTERN EVERGREEN FORMATION
AND/OR HUTTON SANDSTONE



To accompany Record 1968/53

The coarser sandstones grade to grits and pebbly sandstones, in which quartz is dominant and lesser clasts include quartzite, chert and silicified sandstone; clay clasts are common in some beds. The pebbles are normally angular. Beds are generally only a few feet thick and are lensoid in form over a few hundred feet.

The siltstone is quite subordinate to the sandstone, into which it grades. It is grey, weathering to whitish, is carbonaceous in some beds, and is generally laminated to thinly bedded. It may show crosslamination and ripple marks.

The upper part of the unit is penetrated in BMR Chinchilla No.7 (Fig.5). The sequence there consists largely of pale grey very fine and fine grained clayey feldspathic sublabile to quartzose sandstone grading to siltstone, and contains a little coaly debris. An interesting point is that no calcareous beds were noticed in this hole, although there are some in adjacent outcrops. The upper 80 feet of this hole is probably basal Hutton Sandstone.

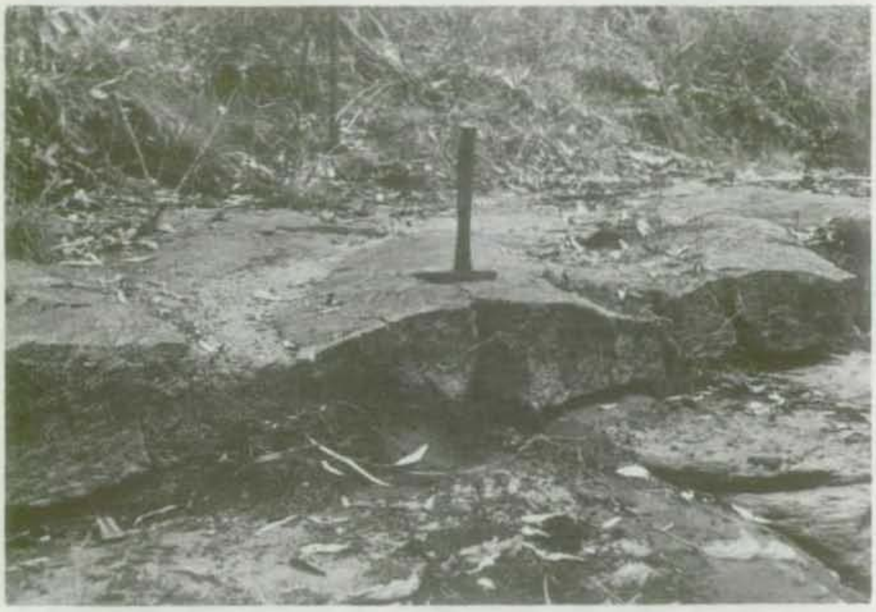
In the south, where exposure is better and the better bedded finer grained sediments crop out, it can be seen that the regional dip is about 1° to the south.

The formation unconformably overlies the metamorphic unit Mm of the Yarraman Complex. The boundary is well displayed at several places along the road between Pine View Homestead (GR445697) and Werona Homestead (GR442704) where the Evergreen Formation dips at angles up to 20°, due to late movements within the metamorphics. Angular quartz pebbles from the metamorphics are common in the basal Evergreen in this area.

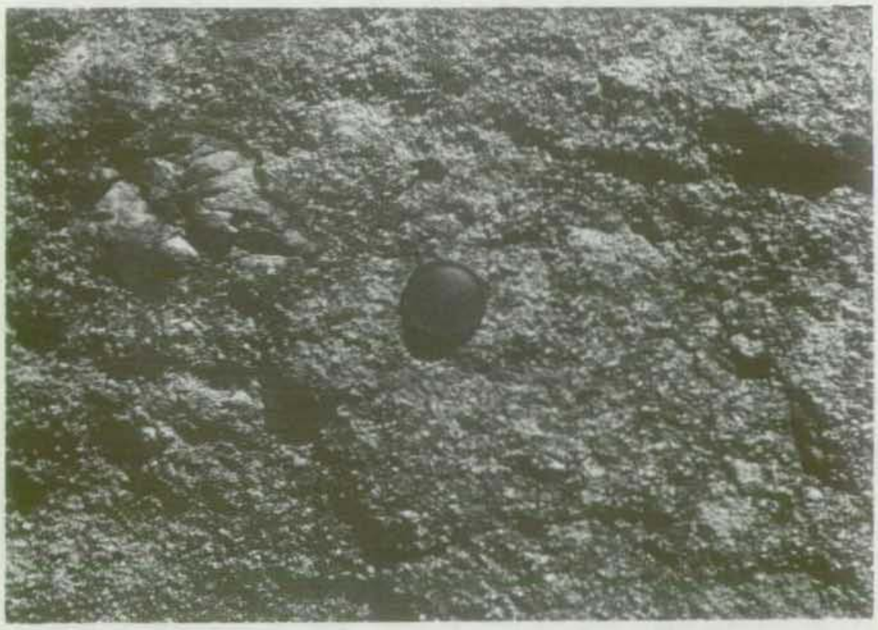
Another place where the unconformity and the basal Evergreen beds are well exposed is in the creek south of Benholme Homestead (437700). The metamorphics consist of schist and gneiss intruded by a porphyry dyke, and with the schistosity striking northerly and dipping to the west. They are overlain by 10 feet of coarse grained massive, pebbly sublabile sandstone, with quartz pebbles to 3 inches across. The contact is somewhat scoured. Above the conglomeratic bed is about five feet of thin to medium-bedded, grey, clayey fine grained feldspathic sandstone. Further up the creek there is about 50 feet of a variety of sublabile to labile sandstone, siltstone and lesser mudstone beds which are quite typical of the Evergreen Formation. At one place (Photoplate 3a) there are giant ripple marks suggesting current movement towards the northeast. In the paddock east of the creek very fine pelletal ironstone is present as scree and may come from high within this sequence. Up the hill to the south (immediately east of the southerly trending branch of the creek) is about 150 feet of medium to thick-bedded clayey sublabile to quartzose sandstone, and thinly bedded siltstone typical of the eastern facies of the Evergreen Formation. Casey, Gray and Reiser (1968) suggested that ~~the~~ lower sandstone in this area could be equated with the Precipice Sandstone. However the senior author (N.F.E.) of the present record disputes this. Similar quartzose to sublabile sandstones with interbedded siltstones occur throughout the eastern Evergreen facies, and the basal sands are generally quite coarse grained. A poor supply of salty water has been obtained from 250 feet in the homestead bore (presumably from these sands).

The contact with the overlying Hutton Sandstone can be mapped with reasonable certainty only in the west, where the characteristic yellowish sublabile sandstones of the Evergreen Formation give way to white, thick-bedded, crossbedded quartzose sandstones of the Hutton Sandstone. Even in the west the boundary is dubious in places. At the site of BMR Chinchilla No.6 for example, just south of Diamondy Homestead (GR 430697), there appears to be a sharp break in outcrop with about 80 feet of thickly bedded, crossbedded, fine to coarse grained white friable quartzose sandstone of the Hutton Sandstone overlying 15 feet of thin to medium-bedded clayey feldspathic sublabile sandstone of the Evergreen Formation. However, in the drill hole, the Hutton Sandstone proves to be clayey feldspathic sublabile sandstone and similar sandstones appear further down the hole.

Southeast of the Diamondy area, hills with several hundred feet of section contain repetitions of apparently quartzose sandstone horizons from top to bottom. As these possibly straddle the Hutton/Evergreen boundary, and in any case, Hutton-like sandstones are common in the Evergreen to the south, the Hutton has not been differentiated



a. Giant ripple marks low in Evergreen Formation. Consist of gritty, somewhat silicified sublabile sandstone resting on fine grained feldspathic sandstone
(M.R. 437 699)



b. "Granite wash" in basal Evergreen Formation immediately overlying granite. Forms massive bed 15' thick.
(M.R. 447 695)

south of here. In may in fact be present in the area between the Rockies Homestead (GR426684) and Karrweena Homestead (GR436676), but the Jurassic outcrops have all been incorporated in Jle_e for this map. South of Karrweena Homestead the Hutton and Evergreen have not been differentiated. Equivalents of both must be present there, but there is nowhere an obvious lithological change, and the two units are not differentiable by regional mapping methods.

The thickness of the eastern facies of the Evergreen Formation is not known with any certainty, and probably varies considerably depending on basement relief. An estimate of more than 400 feet would seem reasonable.

There is no evidence of marine conditions in this area. The thick-bedded, crossbedded sandstones were deposited as channel sands and point bar deposits by streams draining from the Yarraman Complex and running to the south and west. The well-bedded, well sorted, fine grained sands and silts which are coaly or calcareous in places, suggest deposition in quiet freshwater conditions - lakes or backswamps.

BMR Chinchilla No.9, which was drilled after the map went to press, has shown that the eastern facies probably represents at least most of the western Evergreen Formation. This hole, near Werona Homestead (441703), penetrated 50 feet of mudstone and 250 feet of tough sublabile sandstone with some coal, before reaching basement(Mm). It spudded in the lower (northernmost) part of the outcrop. The pelletal horizon of Fairview Homestead was expected at about 50 feet, but was not seen in the cuttings. However, Elizabeth Kemp has examined a core sample from 59 feet palynologically. It contained a spore assemblage (but no acritarchs) of which she says "The combination of abundant Classopollis with the presence of Cadargasporites reticulatus, and the virtual absence of Tongaepollenites suggests unit J1, or at most very low in J2". This means that the pelletal band at roughly that level could easily represent the oolitic ironstone member. A core sample from 306 feet contained a few spores including Classopollis which means that unit J1 probably extends for some 250 feet in the well.

Basinal facies

Many oil wells have been drilled in the west and south of Chinchilla area, well into the Surat Basin. There the Evergreen sequence in the subsurface is more similar to that in outcrop in the Mundubbera and Taroom Sheet areas to the northwest, than to the marginal facies found in much of this area.

In general, the formation becomes progressively less sandy further into the basin, but even well into the basin a lower more sandy part, and an upper more silty part are present. The authors have merely worked from company information as yet, and what we know of the Evergreen Formation in the basin facies in this area is summarized in Plates 10 and 11. Table 2 gives a list of well completion and summary reports for subsidized wells available at the Bureau of Mineral Resources.

Fortunately the Evergreen Formation is a level of interest to the oil companies (e.g. oil in U.K.A. Conloi No.1) and full sets of wireline logs and cuttings are available. In the subsurface in the Wandoan/Miles area the Evergreen Formation consists of siltstone, mudstone and fine grained lithic sandstone, with very few porous and permeable horizons. The oolitic ironstone member has not been identified in many of the wells, but where it has been especially looked for it has been found. Thus in U.K.A. Wandoan No.1 and U.K.A. Burunga No. 1 two pelletal levels have been identified after careful petrographic work (Bastian, 1965a). Bastian (op.cit.) noted a 10 foot thick upper pelletal horizon and a 40 foot thick lower horizon in the interval 2750 to 2840 feet in U.K.A. Wandoan No.1. By correlation through U.K.A. Burunga No.1 with BMR No.29 (Mundubbera) and outcrop, he came to the conclusion that the oolitic ironstone member of outcrop is the lower pelletal horizon in U.K.A. Wandoan No.1. He also decided that the upper pelletal horizon was equivalent to the Westgrove Ironstone Member. Whether or not the correlations are right in detail, it is apparent that oolitic horizons in outcrop and the subsurface are roughly coincident. Acritarchs are present in the pelletal levels in the subsurface, as they are in outcrop.

The quartzose Boxvale Sandstone Member of the western side of the Mimosa Syncline does not appear to be present in this area, although the oil sand in U.K.A. Conloi No.1 may possibly be equivalent to it.

The Evergreen Formation in the subsurface is remarkably consistent in thickness. In most of the area it is between 500 and 600 feet thick (Plates 10 and 11). Only where it rests directly on basement rock is it appreciably thinner - 284 feet in U.K.A. Bullock Creek No.1. This is in sharp contrast to the rapidly varying Precipice Sandstone which appears to have filled all the depressions before Evergreen times.

The basinal facies of the formation may have been partly marine, but apart from the oolitic beds there is little evidence of this. The sediments involved could equally well have been deposited in a series of freshwater lakes, swamps and deltas, and on plains as stream deposits, as in a quiet marine basin.

Hutton Sandstone

The name "Hutton Sandstone" was first used by Reeves (1947); the type section was measured near Hutton Creek east-northeast of Injune (Mollan, Exon and Forbes, 1965), and will be published in Mollan, Forbes, Jensen, Exon and Gregory (in prep.). In the type section the formation is about 400 feet thick and is almost entirely fine to medium-grained, thick-bedded quartzose to sublabile sandstone. Scour cross-bedding is typical of the Hutton Sandstone.

The Hutton Sandstone is very widespread in outcrop and in the subsurface throughout the Surat and Eromanga Basins. It crops out as a continuous belt from north of Tambo to the Chinchilla Sheet area, where it forms a broad expanse of sandy country trending northwesterly. Sand cover is very extensive, and much of the formation is heavily weathered. However a good overall picture of the Hutton Sandstone can be built up from the better exposures in areas of greater relief. Scarps cannot be traced for more than a few miles on the airphotos and little idea of dip can be obtained. The formation is covered with pines or open eucalypt forest consisting largely of spotted gum and stringybark. Much of it is in the forestry area north of Chinchilla and is covered with formed roads; several sawmills are present in the area.

In this area the Hutton Sandstone is still dominantly an arenaceous unit, but siltstone is abundant at some levels. The sandstone is white to brown, and varies from labile to quartzose but is always clayey. In many places it is very heavily weathered and ferruginized. In some areas a ferruginized sandy palaeosoil is widespread.

Typically the formation consists of an alternation of thickly bedded, strongly crossbedded (both scour and planar) poorly size sorted point bar and channel sands, and overbank deposits of thinly bedded, crosslaminated and ripple marked, fine grained sandstone grading tc siltstone. Mudclasts are common in the sandstones, and worm tubes and tracks, and plant roots and leaves are common in the finer sediments.

The lower 50 to 100 feet of the unit normally consists of fine to medium grained sandstone with a few gritty bands. These are predominantly lateral accretion deposits and are well exposed on Round Mountain (397724). In places there are calcareous beds low in the Hutton as on the hill at GR386737. In the east the basal few feet is commonly pebbly, with clasts of quartz, chert and fine grained sediment.

Above this basal sandy sequence is a silty horizon perhaps 50 feet thick. Above this again are alternations of coarser and finer sandstones and siltstones which probably vary from area to area. A good exposure of a silty level is at GR332744 (on the road about one mile west of the fire tower) where there is 20 feet of thin to medium-bedded, well bedded tough white clayey siltstone with muscovite and biotite partings. This grades into very fine and fine-grained clayey sublabile sandstone with clay clasts in some beds. 25 feet of similar material is exposed on the track at GR326758, where laminated grey siltstone and mudstone with abundant plant remains are important constituents.

The upper 200 feet or so of the formation is more labile than the rest. For example, along the Wandoan-Auburn road the upper part of the Hutton Sandstone consists largely of well-bedded, thin to medium-bedded, very fine grained, greenish coloured, very clayey labile sandstone. In White Creek it is cleaner, and displays exceedingly regular bedding. Barchan-type ripple marks and low-angle crossbedding suggest deposition on the flood plain of a north-flowing river. One crossbed shows contemporaneous slumping. Grits, pebbly sandstones and conglomerates are quite common in the upper part of the formation in the west. These consist of angular pebbles of quartz, quartzite, chert, siltstone and mudstone in a poorly sorted sandy matrix. Beds are massive with strongly developed high-angle crossbedding. Many of these sandstones are remarkably porous and may be labile when fresh. Similar beds crop out high in the formation at least as far east as the gullies at GR393714.

This upper highly variable, quite labile part of the formation could correspond to the Eurombah Beds in the Roma area (Exon et al, 1967).

East of the Durong plain, the Hutton Sandstone could be differentiated from the underlying Evergreen Formation only as far east as Diamondy Homestead. Beyond these both units consist of sublabile and labile sandstone, with some pebbly beds, and siltstone. The bedding characteristics of both become identical, varying from crossbedded thick beds to well bedded thin beds and laminae.

A study of thin sections (see Appendix 1) shows that there is little change in the constituents of the outcropping sandstones, either vertically or laterally. Most are labile or sublabile types with clasts of quartz, considerable sediment, acid volcanics and quartzite, variable amounts of both feldspars, ubiquitous muscovite, and some detrital iron ore. Zircon is a common accessory, and tourmaline and biotite are present in some rocks. There is abundant clay matrix, except where the rock is calcareous.

The only reliable thickness estimates come from the subsurface (see Plates 10 and 11) where the formation is generally about 800 feet thick, but slightly thicker in the northwest. The vertically and laterally varying nature of the formation is well shown in these correlation charts; it is dominantly sandy but silty horizons occur at various and changeable levels. The contact with the underlying silty basinal facies of the Evergreen Formation and the overlying mudstones of the Injune Creek Group (which are normally taken as the base of that unit in company reports) is very well marked.

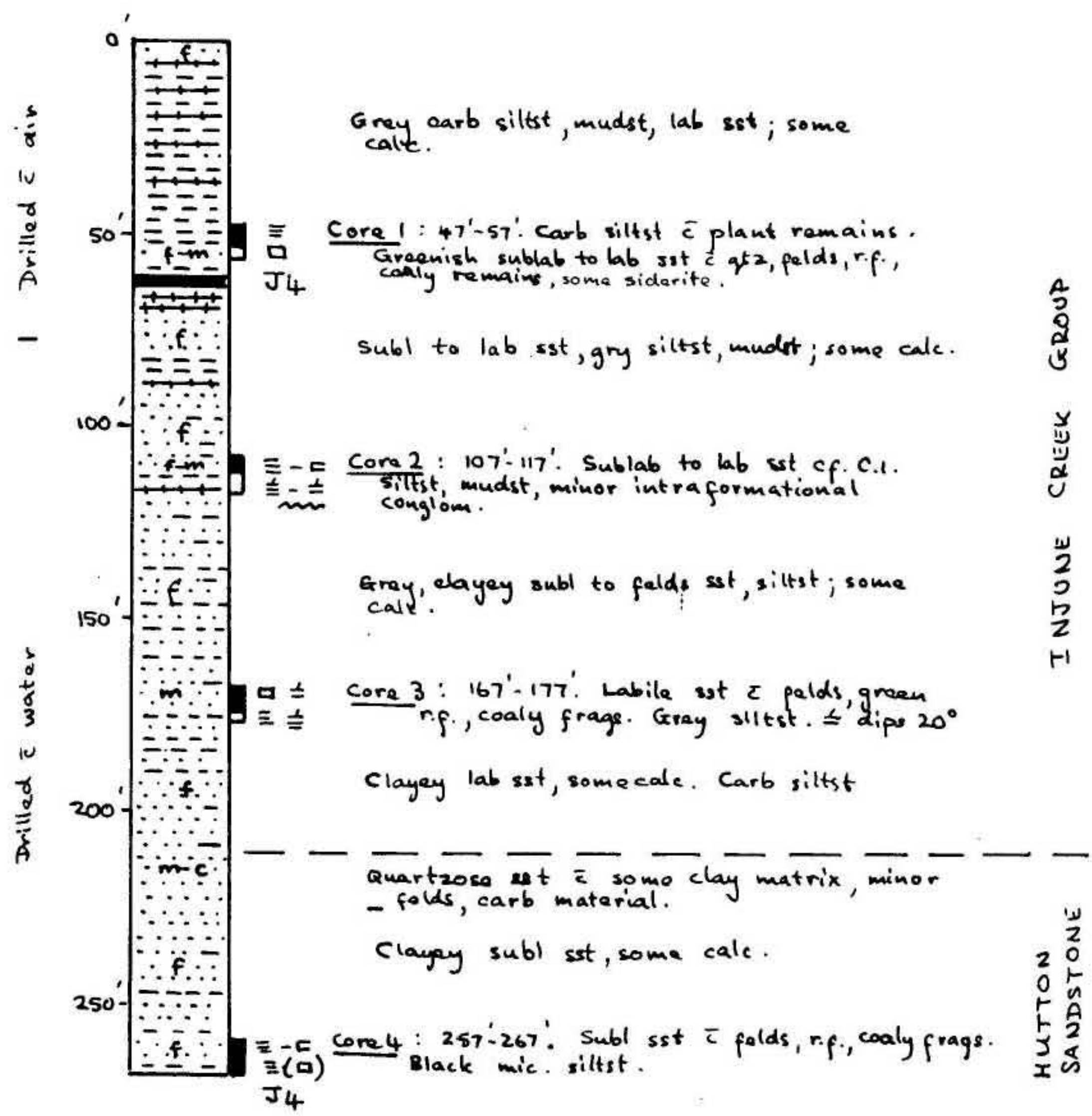
The unit conformably overlies the Evergreen Formation. While the underlying sediments remain very fine grained and thinly and well bedded, the overlying crossbedded, thick-bedded and coarser grained basal Hutton Sandstone is readily distinguished on the ground, though not in the airphotographs. The contact was carefully traced from the west, where the contrast is greatest, to the east. The two formations become so similar in the southeast that it was found impossible to separate them at this scale of mapping, although BMR Chinchilla No.7 (Fig.5) may fortuitously have intersected the boundary.

The contact with the overlying mudstones and calcareous lithic sandstones of the Injune Creek Group is somewhat gradational. By experience it was found that, in the northwest where the contact is not covered by later sand, there is a sharp change from fairly sandy soil and pine cover to clayey black or brown soil and brigalow vegetation. This corresponds with the change from the friable sandstone of the Hutton to the clayey massive sandstone and mudstone of the Injune Creek Group. In the subsurface in BMR Chinchilla No.3 (see Fig.6) the boundary is very difficult to identify lithologically. Whether the interval 80 to 210 feet should be regarded as Injune Creek Group as shown, or Eurombah Beds, is a matter of debate. We suspect that 80 feet would be a typical base of the Injune Creek Group as shown on electric logs. Unfortunately our logging machine was not working at the time. In most of the area the contact is covered by sand or residual soil.

The environment of deposition in this area is fundamentally fluviatile, with normal lateral and vertical accretion deposits. Crossbedding data suggests streams flowing in a northeasterly direction in most of the area, and in a northerly direction in the east. The provenance was partly pre-existing sediments and partly granites. The New England Highway may have provided much of the detritus. Some local ponding and development of lakes is probable.

DRILL HOLE BMR CHINCHILLA No 3.

INJUNE CREEK GROUP
TO
HUTTON SANDSTONE



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To accompany Record 1968/53

The Hutton Sandstone contains some plant material but no collections were made on this survey. In general it contains spores of Evans' (1966) division J2-3 of Lower Jurassic age. The occurrence of spores of division J4, in core 4 of BMR Chinchilla No.3 (Fig.6), in what has been mapped as Hutton in this area, suggests that the upper Hutton may possibly be equivalent to the Eurombah Beds of the Roma area (see Appendix 2).

This formation forms the best of the poor aquifers of this area, with water coming mainly from the upper 200 feet of the sequence, but supplies are considerably less than those found further west in the Great Artesian Basin.

Injune Creek Group

The term "Injune Creek Coal Beds" was first used by Jensen (1921) for Jurassic sediments in the Roma-Injune area. The unit was included in the "Lower Walloon", Walloon apparently having been used by Jensen for all the Jurassic sediments in Queensland. In later publications, Jensen did not use "Injune Creek Coal Beds" but instead subdivided the Walloon Coal Measures into "Upper", "Middle", "Lower" and"Basal" Walloon Formations. Reeves (1947) used "Lower Walloon Series" for the Walloon Formation. Laing (in Hill and Denmead, 1960) suggested that it would be preferable to revive the term "Injune Creek Beds" for the Roma-Injune area. Jensen et al. (1964) applied the name to the Jurassic sequence between the Hutton Sandstone and the Gubberamunda Sandstone, in that area. Exon (1966) raised the unit to group status, and proposed various subdivisions of the group, applic-able in different areas. In the Roma-Injune area the subdivisions were: Birkhead Formation (largely mudstone) with upper Springbok Sandstone Lens (raised to member in Mollan et al., in prep., and more-recently raised to formation status by Power and Devine, 1968), and overlying it the silty Westbourne Formation.

The Injune Creek Group can be traced from north of Tambo to this area in outcrop, and is very widespread in the subsurface.

In this area, as on eastern Roma Sheet (Exon et al., 1967), no subdivisionsof the group are mappable at the surface, although the Birkhead Formation persists as the lower part of the group in the western wells in the subsurface (see Plates 10 and 11; low SP, SN area at base of Injune Creek Group). The position in Phillips Kogan No.1 is somewhat obscure, as the lithological log shows no coals (which characterize the formation) in the lower part of the group.

It has long been considered that the coal measures of the Birkhead Formation in the Eromanga and Surat Basins, and those of the Walloon Coal Measures in the Ipswich Basin are equivalent, and palynological evidence supports this.

Although Power and Devine (1968) claim that the two units form one rock body, and hence that the earlier name Walloon Coal Measures should replace Birkhead Formation throughout, this claim appears to be based entirely on photogeological work linking the two basins, by Jorgenson and Barton (1966). As this evidence is highly interpretive we prefer to retain the name Birkhead at this stage, in case there are facies changes in the area between the Yarraman Block and the Texas High.

The unit crops out only in the northwestern corner of the Chinchilla Sheet, and there poorly; scarps of weathered Orallo Formation and Tertiary sandstone bound the unit to the southeast. The outcrop area consists of rolling country with heavy clay soils; the area is intensively cultivated and grain crops are very widespread. In the south the drainage seems to follow the northwest and northeast trends of the fault pattern. The group can be traced in the subsurface below the Cainozoic cover across the Sheet above the Hutton Sandstone. The coals which occur in the group help to trace it in water bores. The dominant outcropping rock type is khaki to pale grey very fine to medium grained calcareous (or leached) clayey lithic or labile sandstone. This is largely medium to thick-bedded with high-angle crossbeds, but thinner beds with low-angle crossbeds are also common. In good outcrops, for example in cuttings along the Miles-Wandoan road, these sandstones consist of leached friable sandstone beds with ovoid calcareous concretions a few feet in length in some horizons. This is a recent weathering phenomenon, as calcite is quite evenly distributed in the subsurface.

In handspecimen these sandstones are moderately well size sorted with subangular to subrounded grains. Green rock fragments, feldspar and some rose quartz are visible. Only two samples were thin sectioned; these contained abundant quartz, sedimentary and andesitic rock fragments, potash feldspar and plagioclase, and lesser magnetite and muscovite. Clay matrix and calcite cement made up nearly half of the rock.

In places laminated grey carbonaceous siltstone and mudstone crop out, and these are very abundant in the subsurface. Coal is commonly recovered from seismic shot holes, and several thin coal seams have been seen in outcrop in the south. Coal from the group was mined at the Maranoa Colliery near Injune (Taroom Sheet), for many years, and on a small scale, near Jimbour House in this area.

It is apparent from outcrop and subsurface data that sandstone is much more common in the upper three-quarters of the unit than in the lower one-quarter. The contact with the underlying Hutton Sandstone is transitional in that labile sands and silts occur between the typical Hutton Sandstone and the typical mudstone of the Birkhead Formation. In outcrop the boundary has been placed between the friable, somewhat less labile sands of the upper Hutton Sandstone (Eurombah Beds equivalent) and the clayey calcareous lithic sands, silts and muds of typical Injune Creek Group aspect. In the subsurface as in BMR Chinchilla No.3, this boundary is very hard to pick, and although the base of the Injune Creek Group in that hole was put at 210 feet, this was somewhat arbitrary. Normal oil company practice in this area is to put the base of the Injune Creek Group at the base of the mudstone sequence, which is about 150 feet higher than our outcrop boundary; we have perforce followed company practice in our subsurface correlations (Plates 10 and 11), as their picks are the only possible ones without detailed petrological work on cuttings from the wells. Also we could then use the picks from unsubsidized wells available in GSQ 1960-64, and Queensland Mines Department 1965-66.

The Injune Creek Group contains abundant andesitic volcanic detritus which suggests contemporaneous volcanism. The basal sands and silts were laid down by the same streams that deposited the Hutton Sandstone, but these were no longer very energetic. Then followed a period of dominantly back-swamp and lacustrine deposition giving rise to the muds and coals of the typical Birkhead Formation. After that conditions varied from time to time and place to place. Sands, silts, muds and coals were deposited by streams and in deltas and lakes. The widespread calcite suggests a restricted environment for the group.

No reliable estimate of thickness can be made in outcrop but the subsurface thickness is quite consistent (see Plates 10 and 11). The group is nearly 2000 feet thick in the Mimosa Syncline, which must have been subsiding during deposition, enabling it to collect more sediment, but thins to less than 1500 feet in the southeast at Phillips Yarrala No.1.

Fragmentary plant remains are common in the group but none were collected in this area. Palaeobotanical determinations by Whitehouse (1954) indicate a probable Jurassic age. Evans (1960) has found spores of his divisions J4 and J5 in the Birkhead Formation and he assigns a Middle Jurassic age to it. De Jersey and Paten (1964), also on palynological information, assign a Middle Jurassic age to the Birkhead Formation near Injune, and also to the Walloon Formation in the Ipswich Basin. Burger (see Appendix 2) has obtained J4 spores from core 1 (Birkhead Formation) in BMR Chinchilla No.3. Evans (1966c) has found J5 and J6 spores in the Westbourne Formation in the Mitchell area, and believes these to be of Upper Jurassic age. The Westbourne Formation is believed to be equivalent to the upper Injune Creek Group in this area. Thus the age of the group is Middle to Upper Jurassic.

Orallo Formation

Day (1964) discussed the various names of this unit and formalized the name Orallo Formation to replace the Orallo Coal Measures (Jensen, 1960), because the unit has no known workable coal. The formation is equivalent to the "Fossil Wood Stage" or "Series" of Reeves (1947). Day designated the type area as the vicinity of the Roma to Injune road via Orallo, between Nareeten and Hunterton (Roma Sheet). Typical rock types around Orallo are fine grained, thin-bedded siltstone and friable, medium to coarse grained, calcareous labile sandstone; fossil wood is abundant. No type section was measured because the formation is poorly exposed.

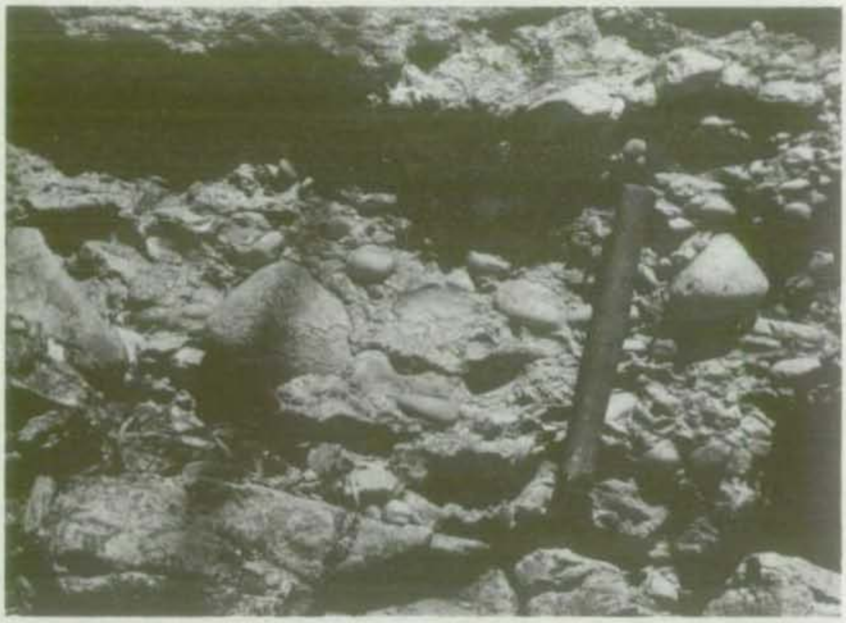
The Orallo Formation crops out in the Surat Basin from the Nebine Ridge to the Chinchilla Sheet and thence south. In the Mitchell Sheet area it was mapped as part of the Southlands Formation (see Exon et al., 1967). It is also widespread in the subsurface. In the Chinchilla Sheet area this clayey unit is unresistant where fresh, and commonly cleared for farming. In deeply weathered areas it forms mesas and is covered with pines or eucalypts. It trends south-southeast in the Miles area, but there swings north towards Chinchilla before swinging south-southeast again and continuing across Dalby Sheet. In general, outcrop in the unit is deeply weathered and not particularly extensive.

The formation consists largely of labile sandstone, siltstone and mudstone. Polymictic conglomerates are locally abundant, especially towards the base in the far west. The sandstone is very clayey and contains clasts of quartz, intermediate to acid volcanics, sediments and both potash and plagioclase feldspar, in varying proportions. Muscovite, rose quartz, mudclasts, clay altered wood fragments, and zircon occur in some beds. Calcareous beds occur, but are rare. The grainsize varies from very fine to very coarse; sorting worsens, bedding thickens and crossbedding changes from low, with ripple marks in places, to high-angle with the change in grainsize. In general the lower sandstones are coarser grained, higher energy deposits than the upper ones. The finer grained, well bedded sandstones grade to clayey siltstones and mudstones which are more abundant higher in the formation and commonly contain plant debris. The polymictic conglomerates contain cobbles and pebbles of acid porphyry, indurated sediments, basalt, granite and abundant fossil wood (see Photoplate 4). These rock types, apart from the wood, which comes from within the formation, match very well with those exposed in the Auburn Complex and the Carboniferous rocks to the north and northeast.

Four shallow holes (of which 3 were in one locality) were drilled in the unit. BMR Chinchilla No.8 (Fig.7) penetrated the lower part of the sequence in the south. It consists dominantly of fine to medium grained clayey sublabile sandstone (somewhat less labile than the western outcrops) with lesser polymictic pebbly bands and grey carbonaceous siltstone. Outcrops in this area are dominantly thickly-bedded, crossbedded, high-energy fluviatile sandstones.

BMR Chinchilla Nos 1, 2, 2A (Fig.8) penetrated a bentonitic sequence low in the Orallo and probably passing into the Injune Creek Group. This sequence, which is exposed in the scarp on the Miles/ Wandoan road just north of the hole, is discussed in detail in Exon and Duff (1968). It consists of fluviatile sandstone, with siltstone, coal and clay bands. Bentonite seams (see Photoplate 7b) up to 6 feet thick crop out in the scarp, and are also seen in the plain of the Injune Creek Group immediately to the northwest. Exon and Duff (op. cit.) state "In rheological properties several of these samples are as good as the best of Australian bentonites ..., but not as good as Wyoming bentonite as a base for drilling mud". In thin section (Appendix 2 in Exon and Duff, op.cit.), the bentonite consists almost entirely of glass shards. The sandstone contains andesitic rock fragments, very angular labradorite, and a little quartz, set in a montmorillonitic matrix. Similar bentonites occur high in the formation in the Yuleba area (Duff and Milligan, 1967).

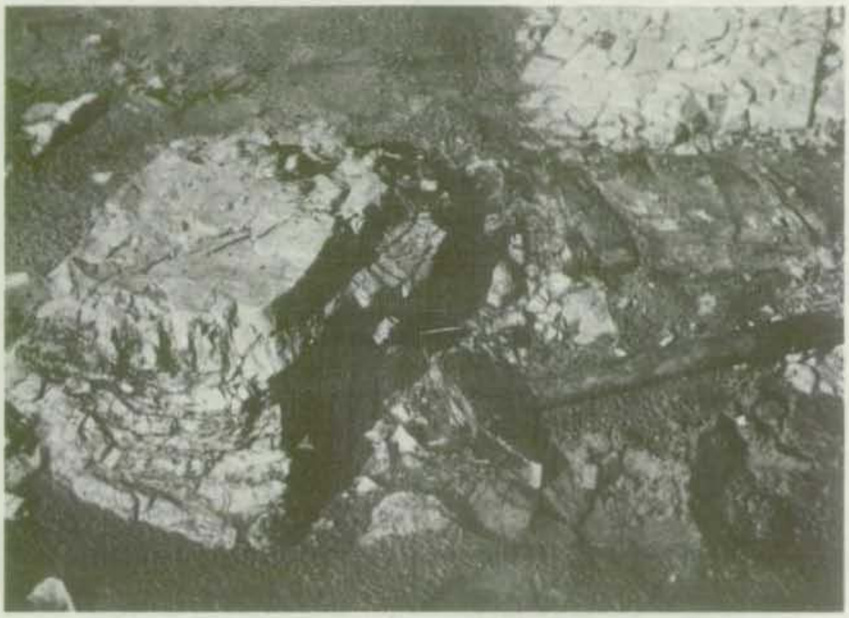
The Orallo Formation overlies the Injune Creek Group with regional conformity in this area. In the Roma Sheet area (Exon et al., 1967) the quartzose Gubberamunda Sandstone separates the two units, but it becomes unrecognizable just west of the Chinchilla Sheet boundary. The Gubberamunda Sandstone is still probably present in the subsurface in this area, in the low area in the southwest (see Plate 10), but



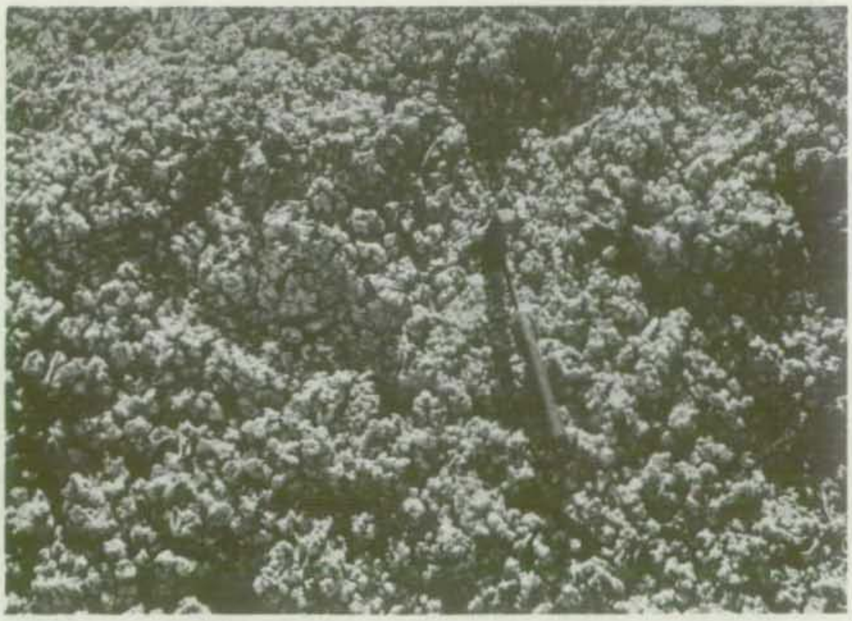
a. Polymictic conglomerate low in Orallo Formation.
(M.R. 293 730)

b. Detritus from conglomerate low in Orallo Formation, showing abundant fossil wood. (M.R. 293 730)

PLATE 7



a. Fossil tree stump in situ in the Orallo Formation. Root runs to the right. (M.R. 302 707 - plant locality SB 617).

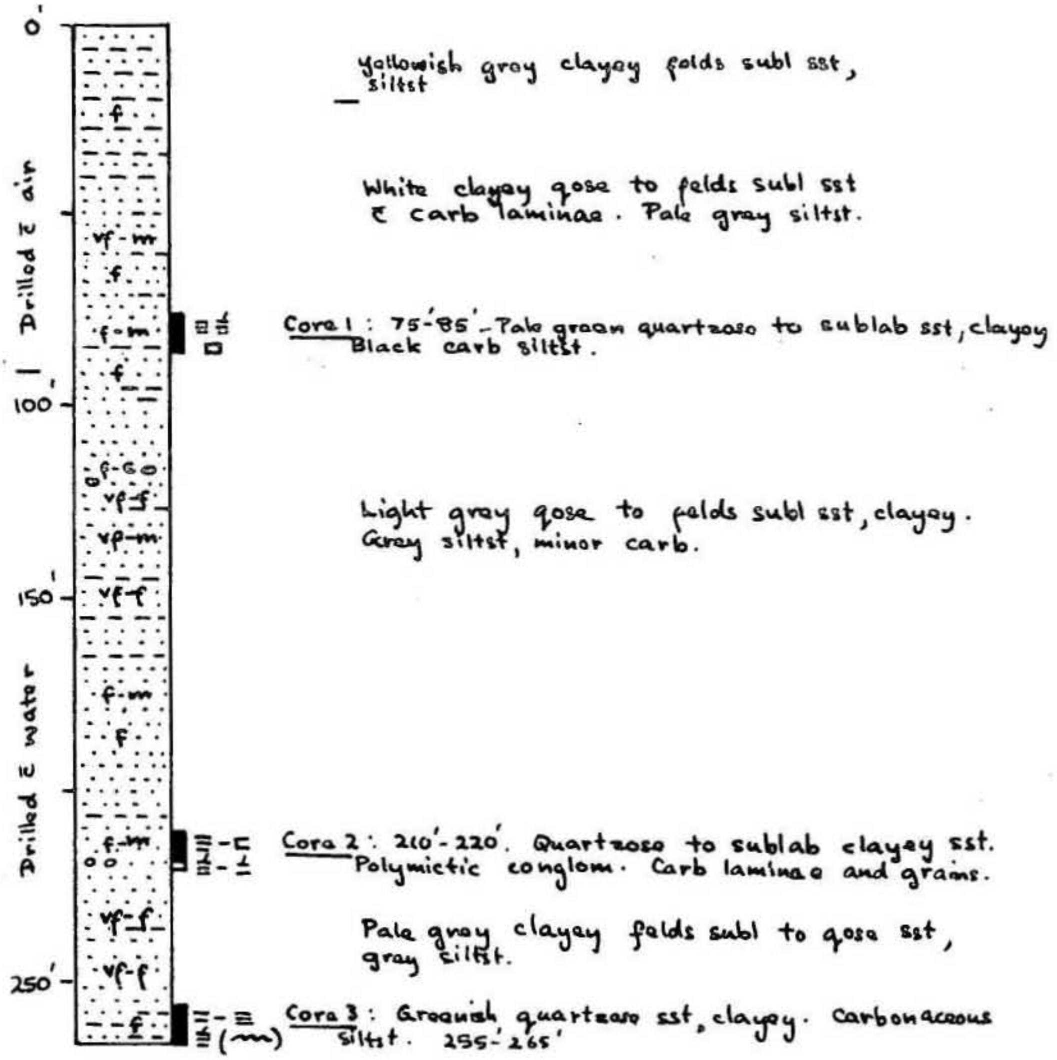


b. Bentonite in scarp at M.R. 299725. Uppermost Injune Creek Group or lowermost Orallo Formation.

FIG. 7

DRILL HOLE BMR CHINCHILLA No. 8.

ORALLO FORMATION



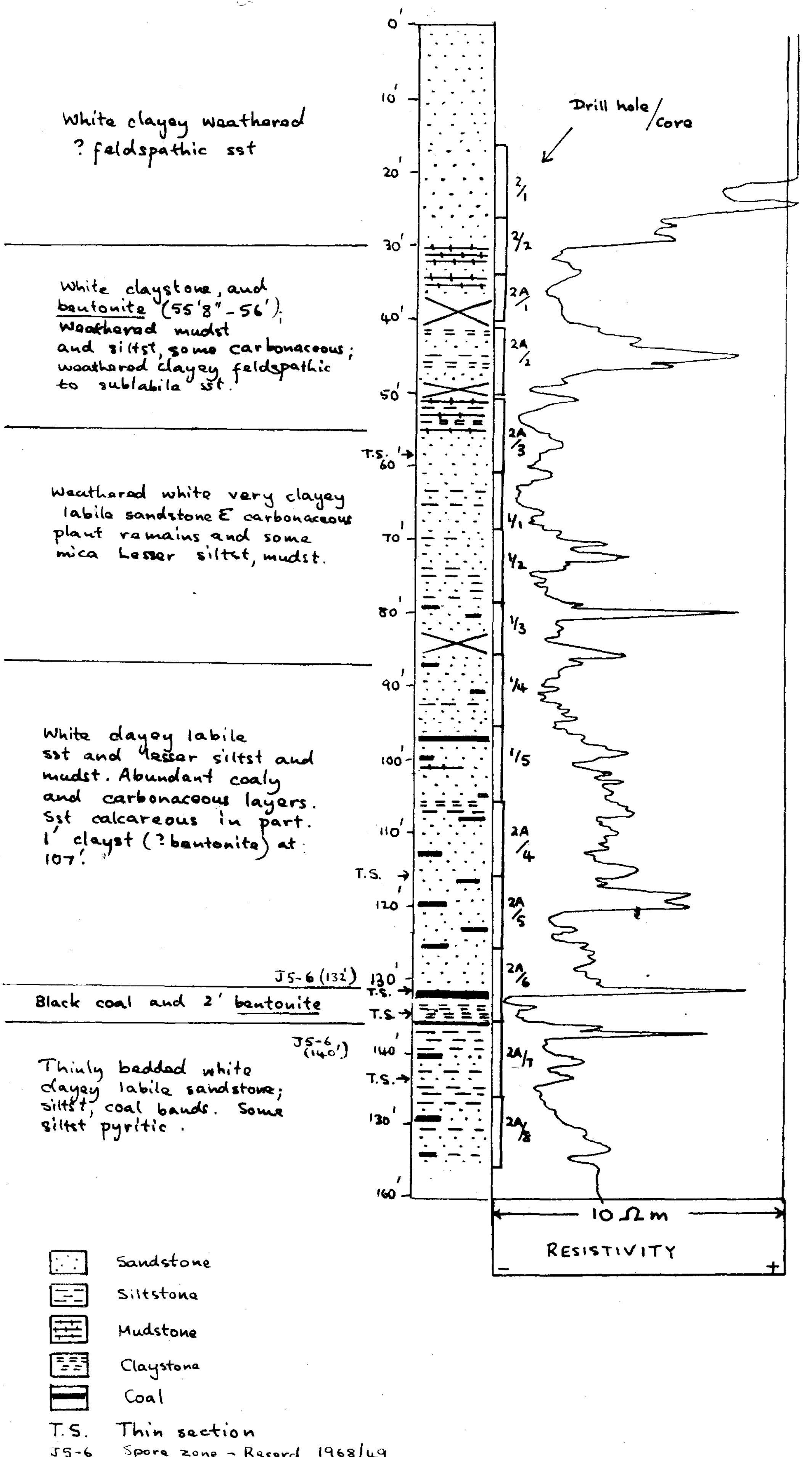
G56/A9/11

To accompany Record 1968/53

Fig. 8

COMPOSITE LOG OF DRILL HOLES
BMR CHINCHILLA Nos 1, 2, 2A

(Drilled on plateau above bentonite outcrops, about 500 yards S of slope and within 10 yards of each other. G.L. 1236')



To accompany Record 1968/53

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pinches out or gives way to a more labile facies up-dip. In outcrop both the Gubberamunda Sandstone on eastern Roma Sheet and the lower part of the Orallo Formation on western Chinchilla Sheet are quite conglomeratic, and the Gubberamunda Sandstone is more labile in the east, which suggests the possibility of equivalence.

Where the conglomeratic lower part of the Orallo Formation is missing, it is difficult to map the contact with the Injune Creek Group with any precision. This is especially so in areas of deep weathering (the outcrops around Chinchilla shown as Orallo on the map, could equally well be part of the Injune Creek Group). In fresh outcrop the sands of the Orallo Formation are generally very clayey and white in colour, whereas those of the Injune Creek Group are greenish and calcareous. Pebbly beds are confined to the Orallo Formation and the lower Orallo sandstones are generally coarser grained than Injune Creek sandstones. In the subsurface, in wireline logs, the two units are readily separated; the lower Orallo is much more sandy than the Injune Creek Group and coals are more abundant in the latter.

The Orallo Formation was derived in part from the Palaeozoic granites and sediments in the north and northeast, and was deposited by south-flowing streams. Early in Orallo times (perhaps starting late in Injune Creek times) there was a burst of andesitic volcanism. Ash rained down into the streams and backswamps, and rock fragments and feldspar were eroded from coarser deposits. It is probable that the vents for this volcanism were along faults in this faulted eastern margin of the Mimosa Syncline. Andesitic debris continued to be provided until the end of Orallo times. As time went on, the energy of the streams diminished, and backswamp and possibly lacustrine conditions predominated. Trees and grasses flourished on the floodplains, but were sometimes wiped out by ash falls, or engulfed by floods.

The thickness of the Orallo Formation is about 400 feet in the Roma area (Exon et al., 1967). In the Chinchilla area it is probably about 600 feet thick in outcrop (e.g. U.K.A. Gurulmundi No.1) and somewhat thicker in the Mimosa Syncline (800 feet) in U.K.A. Burunga No.1).

Plant fossils were collected from four localities in the area and reported on by White (1967). The stratigraphically lowest collection (SB620) was from backswamp deposits in the bentonitic sequence of the scarp at GR299725 and consists of a small, herbaceous Equisitalean of a new species, in situ. This has been provisionally named Neocalamites nuda. White (op.cit.) states "Neocalamites is a Rhaetic genus and Neocalamites nuda has evolved from orthodox type species to become a reduced herbaceous form; a Jurassic age is postulated for the specimens". Another collection (SB617) was made from very well bedded clayey siltstone and fine grained sandstone at GR302706, near the top of the formation. At this locality a tree stump is preserved in situ (Photoplate 70) and beautifully preserved plant fronds lie in the bedding. The plants have been assigned to the Taeniopteroid Yabiella mareyesiaca Oishi, the conifer Elatocladus planus Feist and the fern Cladophlebis australis (Marr.). Y. mareyesiaca is the old "Taeniopteris dunstani" of Walkom, a species which occurs throughout the Ipswich Coal Measures but has not been previously recorded above the Triassic.

The third locality (SB978) is from high in the Orallo Formation (323665) and contains a varied Jurassic flora: Pterophyllum nathorsti (Seward), Taeniopteris spatulata McClell, T. crassinervis (Feist), Ptilophyllum pecten (Phill.), Podozannites gracilis (Arber), Hausmannia sp., Cladophlebis australis (Morr.), ?Phyllopteris, Elatocladus planus (Feist), Gingko digitata Brong., Sphenopteris sp.

Microfossil evidence (Evans, 1966a) indicates that the formation belongs to spore division J6? of Upper Jurassic age. Spores from three cores below 130 feet in BMR Chinchilla Nos 2 and 2A are possibly of division J5, which is probably restricted to pre-Orallo times (Burger; Appendix 1 in Exon and Duff, 1968). Thus that part of the sequence may be of uppermost Injune Creek Group rather than lowermost Orallo Formation age.

Blythesdale Formation

Day (1964) redefined the term "Blythesdale Formation" to resolve the confusion which has existed since Jack (1895) used "Blythesdale Braystone" for a "series of soft, grey, very friable sandstones, grits and conglomerates" at the base of the Lower Cretaceous. Day (op.cit.) explained the evolution of usage of the name Blythesdale in great detail and his interpretation(the generally sandy unit between the "Fossil wood beds" and the Rolling Downs Group) is followed in this record. He designated the junction of Blyth and Twelve Mile Creeks north of Roma as the type area. In the Roma area the formation is divided into four members, in ascending order: Mooga Sandstone, Kingull, Nullawurt Sandstone and Minmi. In outcrop east of Yuleba Creek (Roma Sheet) only the Mooga Sandstone and Minmi Members are present, and in the Chinchilla area the formation cannot be subdivided.

The Blythesdale Formation extends from the Nebine Ridge to the Chinchilla area in outcrop, and is widespread in the subsurface in the Surat Basin, but is not a viable unit in the Eromanga Basin, where it becomes part of the Hooray Sandstone (Exon, 1966). In the Chinchilla Sheet area it is present in the west only, and has been differentiated only north of the Brisbane-Charleville railway line and west of the Miles-Wandoan road, although it undoubtedly extends right down the eastern flank of the Mimosa Syncline and thence southwards. It has not been mapped further south because of its lithological similarity, where deeply weathered, to parts of the underlying Orallo Formation and the overlying Wallumbilla Formation, because of the extensive Cainozoic cover, and because it is complexly faulted. Even in the areas to the north, where it is less altered, the outcrop boundaries are probably not reliable in detail, although the general trend of the unit makes geological sense.

The formation supports pine and eucalypt vegetation. Numerous northwest and northeast trending faults, with minor displacement, cut the unit in this the faulted eastern limb of the Mimosa Syncline.

The outcropping rock types are largely very fine to fine grained clayey quartzose to sublabile sandstone and siltstone. The sandstone is generally thin to medium bedded, with low-angle crossbedding. It is white to buff in colour, and the grains are well rounded. Dark rock fragments, feldspar, muscovite and rose quartz are commonly present. Towards the base there is some poorly sorted, medium to coarse grained, clayey sandstone, thick-bedded with high-angle crossbedding, and with a few quartz pebbles in places.

The siltstone is generally grey and thinly bedded, and grades to mudstone. It is more abundant towards the top where fine grained, poorly sorted, sublabile and labile sandstone is also common.

The formation is much weathered, but where it is fresher, features such as worm tubes and plant debris can be seen. There is a suggestion of subdivision into a lower, coarser, cleaner part (? Mooga Sandstone Member) and an upper, finer grained, more labile part, but this cannot be confirmed. The formation was laid down by streams, in lakes, and probably for the upper part, in a shallow sea (as indicated by marine fossils in the adjacent Roma Sheet).

The contacts with the underlying and overlying units have not been seen. In the Roma Sheet area however, (Exon et al., 1967) both contacts are conformable and there is no reason to suspect that they are not so here.

No idea of thickness can be obtained from outcrop and there are no oil wells in the vicinity. The thickness in the eastern part of the Roma Sheet is estimated at 200 feet. In U.K.A. Cabawin No.1 to the south, the upper fine-grained part is more than 300 feet thick, and the Mooga Sandstone(?) 200 feet thick according to Burger (1968).

The formation contains Evans' (1966a) spore units Kla and Klb-c of Lower Cretaceous age (e.g. Burger, 1968). Microplankton of the <u>Dingodinium</u> <u>cerviculum</u> zone occur in the Minmi Member in the Roma area (e.g. BMR Mitchell No.11 - Burger, 1967). An abundant marine, largely pelecypod fauna of Aptian age occurs in the Minmi Member in the Roma area (Day, 1964 and in press). The Nullawurt Sandstone, in the Merivale Syncline, contains a pelecypod fauna of Neocomian aspect (Day, 1967). Thus it is probable that the Blythesdale Formation extends from earliest Cretaceous times into the Aptian.

Wallumbilla Formation

The Wallumbilla Formation, with its type section in Wallumbilla Creek on the Roma Sheet, was defined by Vine, Day, Milligan, Casey, Galloway and Exon (1967). In the type section it is a sequence of mudstone and siltstone with lesser limestone, sandstone and intraformational conglomerate. The lower, Aptian, part of it is dominantly mudstone and is known as the Doncaster Member. The upper, Albian, part of it is the more silty Coreena Member.

Both members can be traced quite readily latitudinally almost to the western boundary of the Chinchilla Sheet. However, in this area the strike swings northsouth, the dip steepens and the combination of deep weathering, sand cover and some faulting has made it impossible to differentiate these fairly similar members with any certainty. The dominant outcropping lithologies are siltstone and mudstone. It is likely though that they do continue unchanged through this area, as the electric logs and palynology (Burger, 1968) of U.K.A. Cabawin No.1 well suggest that the break-up of the Wallumbilla Formation persists to the south and east.

Not only are the members indistinguishable in most of the area but south of the main railway line we have not found it possible to differentiate the deeply weathered siltstones and fine sandstones of the Blythesdale Formation from the Wallumbilla Formation, and have mapped the whole sequence as undifferentiated Lower Cretaceous.

No fossils have been found in the Wallumbilla Formation in this area but on the Roma Sheet marine macrofossils persist right across the area. The environment of deposition of the Wallumbilla Formation is visualized as fluctuating from freshwater to shallow marine. In the Roma area the Doncaster Member is between 300 and 400 feet thick (about 700 feet in U.K.A. Cabawin No.1) and the Coreena Member 700 or more feet thick (Exon, Milligan, Casey and Galloway, 1967).

CAINOZOIC

Tertiary Volcanics (Tb)

Basic volcanics of probable Tertiary age form a dissected tableland in the southeast of the area, and outliers elsewhere in the east and north. The dominant rock type is basalt but there is also much tuff and minor agglomerate. These rocks give rise to black or red soil, with heavy scrub cover in places; red soil is more characteristic of areas with tuffs.

The large area of basalt to the southeast around Bell is part of the Bunya Mountain complex which is thickest a few miles east of this Sheet. Whitehouse (1954) suggested that the north-northwest trending contact between Mesozoic and Palaeozoic rocks in that area was faulted, and that these basalts were extruded from vents along that line. The form of the flows suggests that they ran in a southwesterly direction across the Bell area, from the Bunya Mountains. Certainly the base of the basalt dips steadily southwestwards. In places there are at least three flows as well as tuffs, and a maximum aggregate thickness of 400 feet is indicated by outcrop and water bore data. No vents are visible in the Bell area. Columnar basalt is well developed in places (e.g. Jimbour quarry, Photoplate 5a).

The basalts vary from very fine grained to porphyritic. The most abundant constituent is plagioclase, with considerable amounts of olivine and pyroxene and lesser magnetite and chlorite (see Appendix 1).

There are several probable vents known in the area. The most southerly of these is Piper Dodge Mountain, certainly a vent, (433703) where there is a dome of microgabbro and gabbro with horizontal foliation developed in places (Photoplate 5b). Immediately to the west is a spur of more normal fine grained and vesicular basalt flows at a lower level.

In the central north (374754) there are three basaltic dome-like bodies aligned on a northerly axis. The most southerly and highest of these, which is locally known as Round Mountain, has a core

a. Columnar basalt of probable Tertiary age in quarry near Jimbour.
(M.R. 431, 654)

b. Horizontally foliated dolerite of probable Tertiary age on Piper Dodge Mountain.
(M.R. 433, 703)

of holocrystalline microgabbro. On the flanks is a rubble of very fine columnar holocrystalline basalt and, around the base, more rubble of typical flow basalt, porphyritic in olivine and pyroxene. This southern hill, which was the only one examined, is almost certainly a vent.

Another possible vent consists of a low rise of basalt and microgabbro in a valley below deeply weathered sediments, in the northwest (309744). Another probable vent is the fault-line north of Warianna Homestead in the north (345765). In the vicinity of this fault are a number of flows, generally aphanitic, with minor olivine phenocrysts. Some are vesicular with chalcedony and zeolite infillings. Many of the other isolated basalt bodies may lie on or near vents, especially those near McTaggart's (1963a) "Yarrol Thrust".

The tuffs are generally very fine grained and heavily weathered. They are very well exposed in Porter's Gap, just east of this area, on the Bunya Highway, where the outcrop is markedly faulted.

In the north, strongly ferruginized fine grained purplish or reddish-grey rocks with swirls and threads of white material are assumed to be weathered tuff.

Three miles north of Durong School, just north of the Proston-Boondooma road (431737), there is an outcrop of basalt and tuff in a gully. A few feet of olivine basalt in the gully has weathered into pillow-like structures about 1 foot in maximum dimension. Above this is 15 feet of fine grained greyish, soft, ferruginous tuff,which contains vertical worm burrows and a few exotic pebbles. In thin section this is largely altered volcanic glass, with abundant iron stained, euhedral zoned pyroxenes to 2mm in length, magnetite grains, and some chalcedony in cavities.

It is certain that basalt was extruded over a very considerable area in the east in the past. Most of the vents were probably in the Bunya Mountains, and basalts flowed down valleys to the southwest, probably overtopping them in places. A considerable amount of pyroclastic material was added to the pile. Elsewhere extrusion was generally localized by fault movements, commonly on old lines of weakness.

In general the basalt is not heavily weathered, though the less resistant pyroclastics generally are. In the vicinity of King's Pit (453660) north of Bell, moderately fresh basalts overlie a tough ferruginous palaeosoil, which may represent the period of deep weathering. We would agree with Whitehouse (see Hill and Denmead, 1960, p.360) that the Bunya basalts are post-lateritization.

The basalts are probably the same age as the contiguous basalts in the Main Range near Toowoomba which gave K/Ar ages of early Miocene (Webb, Stevens and McDougall, 1967). It should also be noted that the nearest dated basalts to the west, those north of Mitchell, have K/Ar ages of early Miocene (Exon, Langford-Smith and McDougall, in prep.).

Since extrusion there has been widespread reversal of relief by erosion of the less resistant intervening sediments, and undercutting of the basalts themselves. However in places near Bell, hills of Jurassic sediments still rise above the basalt.

Tertiary sediments (T)

A veneer of a few tens of feet of leached, commonly iron-stained clayey fine to coarse grained sandstone with lesser pebbly sandstone and siltstone covers large areas in the western half of the Sheet. This is normally thick-bedded and cross-bedded and is of local derivation. Outcrops near and on the Orallo Formation usually contain a selection of the polymictic pebbles, including fossil wood, found in that unit. Most of the sandstones are quartzose and moderately well sorted. This sorting and the comparatively well-bedded nature of these sediments has been used to distinguish them from those assigned to the "undifferentiated Cainozoic" which are assumed to be younger.

In most of the area these sediments are very strongly altered and it is thought that they may have been present when the deep weathering-profile was formed. However, this is very difficult to demonstrate conclusively due to lack of exposed vertical sections. The weathering could be recent and its great effect due to high porosity and permeability. There is also the possibility that these fluvial sands were derived from the deep weathering-profile, and hence have the same character. In the southwestern corner these sands are less weathered but otherwise similar, which tends to support the idea that they are derived from weathered material, as the southwest is downstream and the material has been subjected to more abrasion.

The only control on the age of these sediments is that they are younger than the Lower Cretaceous Wallumbilla Formation. However similar sediments have been assigned to the Tertiary in past field seasons and this convention is followed here.

Notes on the Chinchilla Sand by A. Bartholomai and J.T. Woods.

The name Chinchilla Sand was proposed by Woods (1960) for a dominantly sandy sequence of fluviatile sediments exposed mainly in the valley of the Condamine River for a distance of 40 miles between Nangram Lagoon in the west and Warra in the east. Previously Woods (1956) had used the name Chinchilla Formation for representatives of this sequence in the vicinity of Chinchilla.

The Chinchilla Conglomerate of Etheridge (1892) is a part of the formation, and the thin beds of well lithified calcareous sandstone varying to a grit and conglomerate are prominent in outcrop, including the type section along the north bank of the Condamine River, in the vicinity of the Chinchilla Rifle Range. However the dominant sediment is weakly consolidated sand, grey to yellowish and light brown in colour. There is a gradation to grit on one hand and sandy clay on the other. The coarser clastics contain pebbles of quartzitic material including "billy", and other pebbles of ferruginous sandstone, suggesting derivation from the Orallo Formation, including lateritized profiles of this formation. In fact in a few places at low stream level the Chinchilla Sand can be seen to rest on eroded mottled surfaces of these Mesozoics.

In its most westerly known extent the Chinchilla Sand appears as outliers, but to the east it appears as inliers before disappearing below the dark alluvial clays of Quaternary age. Other Quaternary alluvia show a valley-in-valley relationship with the Chinchilla Sand in the vicinity of the type section, and it is apparent that a small angular unconformity must exist between the Chinchilla Sand and the Quaternary alluvia, with the regional dip of the formation less than or reversed to present stream gradient as well.

The northern boundary of the sequence is difficult to map because of lack of suitable exposure and the similarity of pedocalcic clay soils developed both on the Injune Creek Beds and many parts of the Chinchilla Sand. The remarkably homogeneous orange-red sands so conspicuous in the town of Chinchilla are not part of the Chinchilla Sand, but are apparently younger and represent a high terrace deposit of Charley's Creek.

The measured thickness in the type area is 70 feet, while at least 108 feet is represented in Brown's Bore, Brigalow (on the evidence of samples preserved by the Geological Survey of Queensland).

Vertebrate fossils are common in the Chinchilla Sand, with reptilian remains being particularly abundant. These include teeth and dermal scutes of the large crocodile Pallimnarchus pollens, carapace fragments of the freshwater tortoises, Chelodina insculpta, Chelymys arata, C. uberima, C. antiqua, Pelocomastes ampla and Trionyx australiensis, and teeth and vertebrae of the large goanna, Varanus dirus. Fish remains include buccal plates of the lungfish, Epiceratodus forsteri while the large bird fauna includes fragmentary remains of Anas elapsa, Biziura exhumata, Chosornis praeteritus, Dendrocygna valdipinnis, Fulica prior, Gallinula strenuipes, Nyroca reclusa, N. robusta, Plotus parvus, Porphyrio? reperta, Xenorhynchus nanus, Necraster alacer, Dromaius gracilis, D. patricius, and Platalea subtenuis.

The dominant marsupial is the diprotodontid, Euryzygoma dunense, which is sufficiently abundant to be useful as a guide fossil for the sequence. This is accompanied by other diprotodontids, including Euowenia grata and Palorchestes parvus. Dasyurids are represented by Sarcophilus prior and Thylacinus rostralis, while the phalangerids include Pseudochirus? notabilis and the "marsupial lion" Thylacoleo crassidentatus. Macropodids are moderately abundant, the most common being Sthenurus antiquus, S. notabilis, Troposodon minor, Macropus pan, Protemnodon anak and "Halmaturus" indra.

A tentative Pliocene age was assigned to the Chinchilla Sand by Woods (1960), essentially on this faunal evidence. Earlier Sahni (1920) had assigned a Tertiary age to three specimens of fossil wood from the Condamine, near Fairymeadow, southwest of Chinchilla. These were the conifers Mesembrioxylon fluviale and M. fusiforme and an indeterminable dicotyledon.

Recently evidence of superposition of the Pleistocene alluvia, characterized by the Diprotodon optatus fauna, on the Chinchilla Sand in its subsurface extent has become available at Dalby. A tooth of Euryzygoma dunense was recovered from sands at a depth of 87-90 feet, in the Dalby Town Bore, adjacent to the existing Production Bore No.2, por.16, Par. St. Ruth.

Deep weathering-profile and younger ferruginous material (Czw)

The typical deep weathering-profile in this part of Queensland (see Exon, Milligan, Casey and Galloway, 1967; Exon, Langford-Smith and McDougall, in prep.) consists of up to 100 feet of mildly leached white or reddish sediments from which calcite has been removed and in which feldspar has broken down to clay, and iron oxide has been preferentially deposited in some horizons. In this material mica is still present and all the bedding and grain characteristics of the underlying fresher rocks remain.

Here and there a thin ferruginous capping is preserved, but in general, the crust of the duricrust is missing. In this area such a profile is present in the Orallo Formation and the overlying Cretaceous units in the west of the area. The overlying Tertiary rocks are also heavily weathered but it is not certain whether this is recent weathering or is part of an earlier deep weathering-profile.

In the north and east most hills and most parts of the general land surface are capped with red ferruginous altered material (see Photo plate 6). This material has been called "laterite" in the past, (e.g. Olson 1963 who discussed it in some detail). However, two analyses in this area (Appendix 5) contain less than 10 percent Fe_2O_3. This ferruginous material is present on all units but is particularly well developed on the coarser sediments such as the Hutton Sandstone and the various Cainozoic sandstones of the area.

In general there is a poorly differentiated profile developed, with the material more ferruginous on top and mottled and leached below. The ferruginous material shows none of the bedding features of the underlying units whereas the remainder of the profile commonly does.

The ferruginous material is normally riddled with undulate vertical tubes about half an inch in diameter and several inches long. These could be worm or insect burrows, or possibly due to capillary action as suggested by Connah and Hubble (1960). The authors favour the idea that the ferruginous material is a fossil sandy soil which was readily altered. Where a profile is developed the alteration can be related, probably, to the main period of deep weathering. In many places though, slopes are covered with more recent sand scree which has been ferruginized and "burrowed", and it is probable that this ferruginization is continuing at the present day. However on the map 'Czw' has been used for any very heavy weathering.

Another interesting occurrence of ferruginous material is at GR453660 in the southeast. Here there is about 10 feet of ferruginous silicified palaeosoil below Tertiary basalts. The field relationships are somewhat uncertain but it could overlie another basalt. This palaeosoil follows the contours for at least a mile, and being resistant, is quarried for road fill at one locality. This material varies from very fine to pebbly in a short distance both vertically and laterally. Analysis of one sample (67580951, Appendix 5) shows it to contain 19.3 percent Fe_2O_3. Two thin sections of this material are described in Appendix 1. Perhaps half the pebbles are of granitic provenance (rounded to euhedral feldspar, quartz), whereas the remainder of the material is fine grained and could be derived from the Evergreen Formation. In the vicinity the only outcrops are basalt above and Evergreen Formation below; the nearest granite outcrops are about a dozen miles to the northeast beyond the Bunya Mountains. However, it is quite possible that there are granites above this locality but obscured by basalt, from which the coarser material could have been derived.

a. Typical capping of heavily weathered Cainozoic sandstone and breccia in north. (M.R. 343768)

b. Typical heavily weathered mottled Cainozoic sandstone in north. (M.R. 369742)

The material was apparently ferruginized before deposition of the basalt, and also silicified at some unknown time.

Granite wash (Czg)

In the northeast, sands derived from the granite have been consolidated in situ or after stress transport. They are regarded here as Cainozoic in age though some could be older. The higher level sediments, which are probably mostly older, have been very heavily weathered and consist largely of quartz grains in a clay matrix.

Some of these may, in fact, have been affected by the period of deep weathering, and some contain vertical burrows (see Deep weathering-profile); all these are shown as Czw/Czg on the map.

The lower level sediments along the Boyne River are fresher, although somewhat leached and mottled. Most of these are sandstones showing poorly developed medium to very thick bedding and some cross-bedding. They vary from fine to very coarse to pebbly; clasts are mainly fairly angular quartz and euhedral to subhedral feldspar and there is some clay matrix. Some mudstones are also present.

The cycles of weathering, erosion, transport, deposition, consolidation and further weathering, and of weathering, consolidation and further weathering are continuing to the present day, and become intertwined in some sediments. The same processes obtained at least as far back as Evergreen times, giving rise to the coarse marginal facies of the Evergreen Formation.

Residual soils (Czc)

There are large areas of relatively flat rich black and brown brigalow soils in the east and south of the area. These are largely clays and sandy clays and include the areas differentiated by Isbell (1962) as deep gilgaied soils. This area is continuous with the Chinchilla Sand, which was differentiated on its fossil content and greater coarseness, and with the Pleistocene alluvia of the eastern Darling Downs (Woods, in Hill and Denmead, 1960, pp.397-401). It is cut by some large streams but is obviously not all old alluvium related to these streams.

The soils of these areas are older and generally higher than the modern river alluvium, and probably largely younger than the Chinchilla Sand. In the area around Durong they form a plain above the valley of the Boyne River and are being actively eroded and re-deposited as younger clay and sandy clay (Qs).

The major source of these soils seems to be the Tertiary basalt and the clayey sands and silts of the Evergreen Formation. The basalt was probably much more extensive in the east than it is now and may have mantled most of the area. As it was eroded it was deposited by a combination of stream and gravity action in the valleys and worked into a fairly level surface.

This material is very thick in places. In the Durong plain there is up to 340 feet of alluvium (Olson, 1963). Woods (op. cit.) found from Irrigation and Water Supply records that the maximum recorded thickness of Pleistocene alluvium in this part of the valley of the Condamine River was 163 feet near Clifton on Dalby Sheet. He also mentions a Pleistocene fossil found at 140 feet in a well on Jimbour Plains. The residual soils in the Chinchilla Sheet area are probably the same age as the Pleistocene alluvia further east.

<u>Undifferentiated Cainozoic sediments</u> (Cz)

These are the various consolidated unbedded sediments which overlie the Evergreen Formation and Hutton Sandstone. Typically they are consolidated screes of cobbles, pebbles and sand derived from higher areas. There is also some siltstone. In places they dip away from high areas and are eroded to form cuestas (e.g. around Round Mountain, GR387725).

This material is consolidated by leaching and redeposition of clays and by ferruginization. It is almost certainly later than the period of deep weathering as some of the sandstone cobbles in it are more ferruginous than the host rock. However all outcrops are marked Czw/Cz to show that they are heavily weathered.

Quaternary sediments

The sediments of modern floodplains are distinguished as Qa. These are best developed along the Condamine River. This is a purely photo-interpreted unit and includes some sediments of probable Pleistocene age.

High terraces of the river and general sand and soil cover are known as Qs. In the northern two thirds of the Sheet this consists largely of sand cover on the older units including sand which slopes down onto the older Czc. South of the Condamine River, sand obscures the Orallo Formation on plains below the higher areas of tougher deeply weathered Orallo Formation.

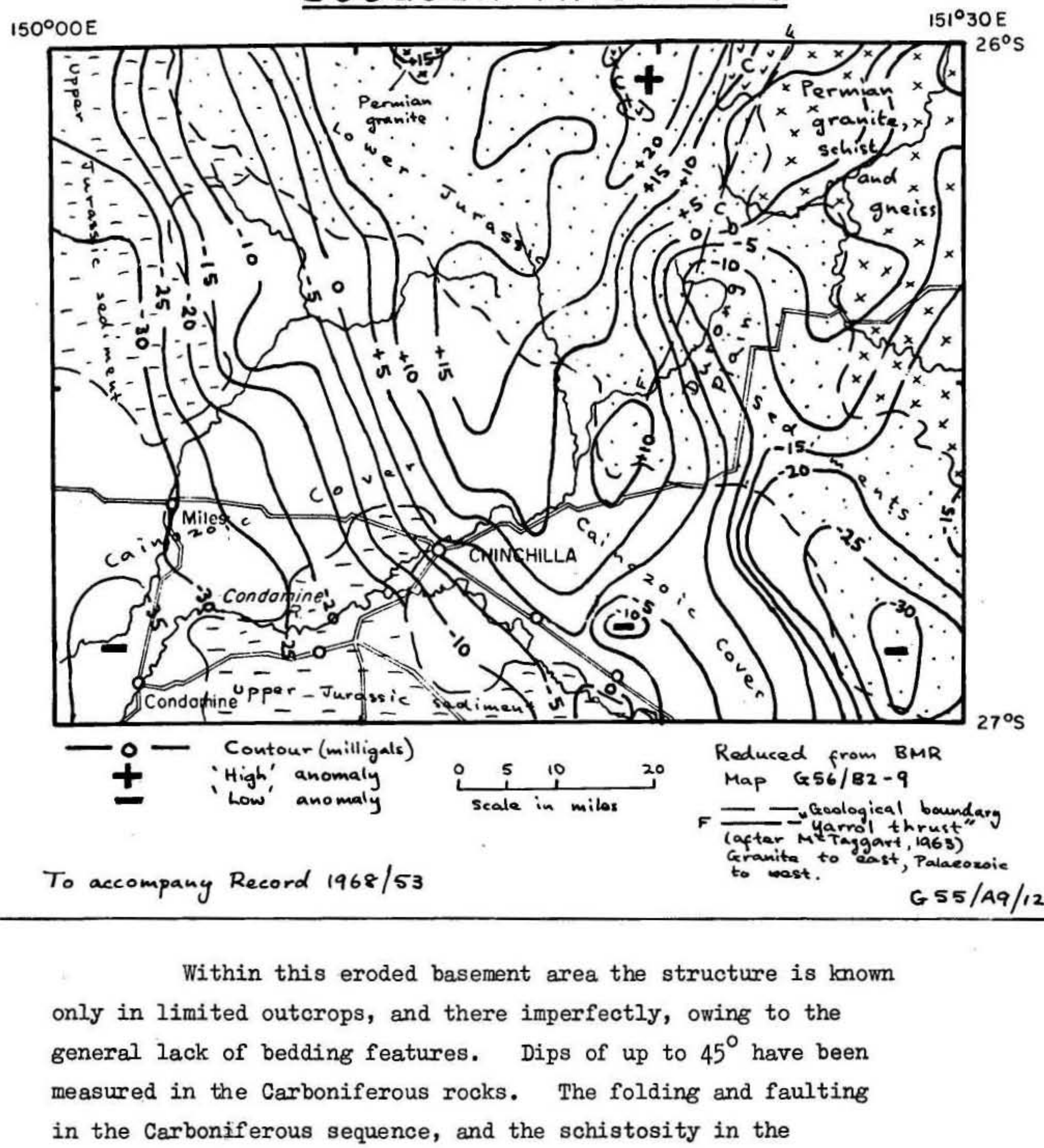
STRUCTURE

The general structure of this area is shown in Plate 8, which is based on well, seismic and gravity data. The geological map cross-section, the well correlation charts (Plates 10 and 11), the gravity data (Fig.9), and water bore and shallow drilling (Plate 9) data all provide structural information. As dips are generally too shallow to measure, useful outcrop information is confined to the trend of units.

Drilling and geophysical work shows that the granite and gneiss of the Yarraman Block in the east, and the strongly folded Palaeozoic sequence elsewhere (see Fig.9) form a basement surface which dips overall to the southwest at about 1^{o}. In the far west (see map cross section) aeromagnetic and seismic work indicates that the dip on the surface steepens to a maximum of 10^{o}, in the faulted east limb of the longitudinal Mimosa Syncline (the axis of which is just west of this area).

Fig.9

GRAVITY
BOUGUER ANOMALIES



Within this eroded basement area the structure is known only in limited outcrops, and there imperfectly, owing to the general lack of bedding features. Dips of up to 45° have been measured in the Carboniferous rocks. The folding and faulting in the Carboniferous sequence, and the schistosity in the metamorphics, strikes in a north-northeasterly direction, as does the faulted margin of the Yarraman Block. It seems that eastwest compressional forces pushed the granite up through the Carboniferous volcanics and sediments both before and after consolidation, first (probably in the Permian) as intrusions, later by faulting along the margins of the Block. Post Lower Jurassic movements in the granitic basement have given local dips of up to 20° in the Evergreen Formation near Pine View Homestead (445697).

Permian and Triassic sediments and volcanics fill the Mimosa Syncline. This was apparently never a deep depression, but rather a steadily subsiding one, and is filled with freshwater and shallow marine sediments. It may contain as much as 25,000 feet of Permo-Triassic strata in places. Dips in the syncline are all quite shallow, except where the sequence is disturbed by faulting.

The east limb of the Mimosa Syncline is complexly faulted. This faulting has persisted throughout the stratigraphic column. In the Lower Jurassic and older rocks it is generally oriented longitudinally although individual faults vary in orientation. The details of this faulting are shown in seismic work for Union Oil Development Corporation (various reports - see Table 1). These faults were produced over a long time as the Mimosa Syncline subsided. There are many small horst and graben structures, which have formed the small anticlines tested for oil accumulations by Union Oil Development Corporation (various reports - see Table 2). As faulting occurred at various times during sedimentation and erosion, the limits of some formations (e.g. Rewan Formation in Fig.2) are fault-controlled.

Faulting in the post-Lower Jurassic sediments is oriented northwest and northeast. This change in orientation may possibly be explained in terms of adjustment on the older faults being taken up by a comparatively incompetent veneer of younger sediments.

Another area of Triassic sedimentation may have been in a trough running from Bell southeastwards, linking with the Esk Trough (Hill and Maxwell, 1968).

<u>The Burunga Anticline</u> was part of the Mimosa Syncline in Permian times, and thousands of feet of Lower and Upper Permian sediments were deposited in the area. However there is virtually no Triassic material on the anticline, indicating either early Triassic uplift and no deposition, or late Triassic uplift and removal of Triassic sediments before Jurassic deposition. The structure was no longer a high in Jurassic times and there are normal thicknesses of Jurassic sediments on it.

At the close of Triassic times much of the area was quite stable and fairly flat, with rises of Carboniferous rocks. The granite of the Yarraman Block, east of McTaggart's (1963a) "Yarrol Thrust", and the Auburn granite, formed high areas separated by the complementary Yarrol Basin graben structure. This graben was filled with Lower Jurassic sediment. It is possible that in lowermost Lower Jurassic times the southern part of the Yarraman Block was an erosional area and that the lower part of the Evergreen Formation was not deposited on the Block in this Sheet area (although it may have been in the probable Triassic trough near Bell, and in the Dalby-Toowoomba area).

Younger sediments, where present, show remarkably consistent thicknesses. It seems that, in the Mimosa Syncline, and the area west of the "Yarrol Thrust", there was little post-Triassic folding of consequence until the Tertiary. The gentle warping in Middle Jurassic to Lower Cretaceous sediments over older structures is probably due largely to differential compaction, with slight movements on some structures.

Possibly in late Cretaceous and certainly in Tertiary times the present gentle basinward dip developed. The flat-lying basalts of the Main Range near Toowoomba are of early Miocene (22 m.y.) age (Webb, Stevens and McDougall, 1967) and unconformably overlie the Mesozoic sedimentary rocks. McTaggart (1963a) suggests that much of the movement may have occurred in the late Cretaceous at the same time as the Maryburian orogeny. He also believes that "post-volcanic uplift of some 1,500 feet has affected the Toowoomba area, resulting in further structural separation of the Surat and Clarence Moreton Basins*

*This post-volcanic movement is widely disputed by later workers in the area.

One remarkable feature which is probably of late Cretaceous or Tertiary age, is the Chinchilla Ridge (named by Cundill, Meyers, and Associates, 1966). This ridge joins the Carboniferous inliers southeast of Hawkwood to the Palaeozoic inliers south of Millmerran (see Plate 8). There is no thinning of Jurassic sediments over it (Plates 10 and 11). The ridge separates the area of steady south-westerly dips around Dalby from the comparatively complexly and faulted area to the west with its steeper basinward dip. The Chinchilla Ridge may mark the hinge line between a more stable block including the Auburn and Yarraman granites and the Texas High, and a less stable block to the west.

GEOLOGICAL HISTORY

In the Carboniferous, great thicknesses of polymictic gravels, lithic sands, silts and muds, and pyroclastic and effusive basic, intermediate and acid volcanics were deposited in conditions which were marine, at least in part. In some areas organisms thrived and limestone reefs were formed. In response to eastwest compression these sediments were strongly folded about northerly axes, and granite was intruded in the east, and central north, probably in the Permian.

The metasediments south of the granite have a schistosity which was probably imposed by the same compressional forces. These forces continued after solidification, causing further uplift of the granite and giving rise to a faulted western contact with the Carboniferous sequence. This movement persisted at least into the Jurassic. Rhyolite dyke swarms penetrated lines of weakness in the upper levels of the granite, probably in the Permian. Basic dykes cut the granite in the central north and, to a lesser extent in the east, and also the Carboniferous sequence in the east.

In the northwestern part of the area andesitic and dacitic tuffs and flows were laid down in the Lower Permian (Camboon Andesite). These, and the Carboniferous rocks in the south, were overlain by thousands of feet of muds, silts, sands and gravels, with some tuffs and much tuffaceous detritus (Back Creek Group) which covered the entire western part of the area. Thin coal seams and some marine fossils suggest conditions varying from freshwater to shallow marine.

The sea then receded and several thousand feet of Upper Permian coal measures and tuffaceous clastics (Blackwater Group) were deposited in fresh water in the steadily subsiding meridional Mimosa Syncline. From then until the Lower Cretaceous the sea did not return to the area.

Triassic fluviatile and lacustrine red-beds (Rewan Formation) which are about 10,000 feet thick in the axis of the syncline, lapped up the eastern flank in this area. More normal freshwater sedimentation followed and a sequence of up to 1500 feet of sand, silt and mud with lesser gravel (Wandoan Formation) was laid down. The sediments contain tuffaceous detritus, and a few acritarchs which suggest ephemeral marine connections. The early sediments were coarse stream deposits, but backswamp and lacustrine deposits predominated later.

At the close of Triassic times the various formations were extensively bevelled. No Permian or Triassic sediments were preserved outside the Mimosa Syncline, but it is not possible to trace their original extent. No Triassic sediments are preserved on the Burunga Anticline which formed in Triassic times, and was bevelled prior to Jurassic deposition.

The faulting of the eastern side of the Mimosa Syncline was a local control of sedimentation and preservation of units. Thus the Rewan Formation was upthrown east of the Burunga Fault Zone and removed by erosion.

In the early Lower Jurassic, sediment was largely derived from the high granite areas in the north and east. Stream gradients were probably high and deposition may have been confined to the south and west of the area, where the clean 200 feet thick lower part of the Precipice Sandstone was laid down. The environment quietened in late Precipice times and several hundred feet of silty backswamp deposits were laid down over a wide area in the south and west.

Near the granites, arkosic sediments were laid down as lateral accretion deposits, and silts and muds in back swamps. In the Yarrol Basin graben these were more than a thousand feet thick, but elsewhere the Evergreen Formation totals 500 feet. Away from the granites more normal Evergreen silts and fine sands were deposited in backswamps, deltas, lakes and possibly shallow marine conditions. Oolitic ironstone horizons coincide with acritarch swarms, but are not present above the Yarraman Block which was a high area.

Then there was an increase in the general energy of transport, and fluviatile sands and backswamp silts were laid down in a blanket across the area. These deposits (Hutton Sandstone) are 1000 feet thick in the northwest and thin to the south and east. They were generally far better sorted than the arkoses of the Evergreen Formation. However, in the east, where they are near the Yarraman granites, they are little different from the sandy Evergreen Formation deposits.

In the Middle Jurassic, conditions quietened again and a coal-measure sequence consisting largely of lithic sand, silt and mud (Injune Creek Group) was laid down by streams, and in lakes and swamps. Andesitic volcanism provided much of the detritus. The group averages 1500 feet in thickness but thickens into the Mimosa Syncline.

In the southwest there followed deposition of several hundred feet of fluviatile quartzose sand (Gubberamunda Sandstone). Elsewhere about 500 feet of Upper Jurassic labile sand and silt (Orallo Formation) was laid down by streams and in lakes directly on the Injune Creek Group. Andesitic ash falls occurred during the Upper Jurassic.

The Lower Cretaceous record in this area is poorly known. However, the earliest deposits (Blythesdale Formation) consisted of a few hundred feet of alternating clean fluviatile sands and silts, and muddy lacustrine sediments. The uppermost member (Minmi) was marine. Then followed deposition of several hundred feet of marine muds (Doncaster Member) and several hundred feet of shoreline silts and sands (Coreena Member).

In post Lower Cretaceous times the area was tilted to the southwest. The hinge line between the stable block of the Auburn and Yarraman granites and the Texas High to the east, and the more mobile area to the west, became the Chinchilla Ridge. The earlier units were extensively bevelled and a veneer of fluviatile Tertiary sandstone was deposited over much of the area. A period of deep weathering led to leaching or ferruginization of exposed Mesozoic and Tertiary sediments and the formation of a profile. Basaltic tuffs and flows covered the southeast of the area to a depth of more than 500 feet.

Erosion and sedimentation continued and the remains of Pliocene vertebrates were preserved in stream sediments along the

Condamine River. Pleistocene alluvium was deposited in a great area north of the present river channel in the east, and on the Durong Plain where it is more than 300 feet thick. The granite mass in the northeast continues to be eroded, and arkosic sediment deposited near stream channels, as it has ever since the Lower Jurassic. Throughout the area the deep weathering-profile has been extensively stripped by late Cainozoic and Recent erosion. Ferruginization of weathered sediments still persists in much of the area. Erosion and deposition also continue .

ECONOMIC GEOLOGY

Water

The Chinchilla Sheet area lacks adequate surface water supplies over much of its extent. South of Chinchilla, the Condamine River provides permanent supplies for stock watering and local irrigation. North of Chinchilla, there are few permanent streams of significant size, and subsurface supplies are utilized during dry seasons. Water bores are comparatively numerous on the Sheet area : the records of over 250 producing bores held by the Queensland Irrigation and Water Supply Commission were examined during the present investigation, and the data available were not exhaustive. Supplies of usable water average about 500 gallons per hour for all the bores considered.

The Chinchilla Sheet area occupies the present-day marginal areas of the Surat Basin. Basement crops out in the northeastern corner, and along the northern boundary of the Sheet area. South of these areas of outcrop, basement underlies the Mesozoic sediments at relatively shallow depth; bores in this area rarely exceed 1000 feet in depth, and none is greater than 2100 feet. In the southwest near the axis of the Mimosa Syncline, the geological setting is more typical of the Surat Basin proper, with greater than 3000 feet of sedimentary section. Bores in this area are shallow simply because of the occurrence of adequate supplies of water at shallow depth and the fact that bores are generally required only as an auxiliary supply to augment supplies from the Condamine River system.

The average rate of production in the water bores is much less than is typical for the deeper bores of the basin proper, which tap the same aquifers. This probably reflects the more local derivation of the ground water supplies, and their smaller hydrostatic heads (only two bores on the Sheet area flowed at the surface). Although individual bores are not prolific, the amount of water drawn from all bores on the Sheet area is very great. The ready availability of water over such a large area is probably the result of an overall high porosity which is greater and more consistently developed than is typical for these aquifers further west. Such porosity is possibly an expression of good sorting in sediments deposited in a shallow-water, basin-margin, and hence high-energy environment.

Water is drawn from aquifers in all the formations from the Precipice Sandstone to the Orallo Formation. The present stratigraphic and structural interpretation suggests that the most abundant water supplies are obtained from a single aquifer, or from a series of aquifers within a limited vertical range, in the top 200 feet of the Hutton Sandstone. Bores tapping this aquifer produce up to 6000 gallons per hour.

There is a small group of bores in the area of outcrop of the lower Evergreen Formation (Jle_1 on the geological sheet), in the northern central part of the Sheet area. One deep bore (1161 feet deep) and several shallow ones (350-560 feet deep) may draw supplies from the Precipice Sandstone; rate of supply varies from 200-800 gallons per hour. Shallow bores (depth less than 200 feet) draw water from medium-grained, porous sands in the lower Evergreen Formation.

In the southwestern part of the Sheet area, aquifers throughout the vertical extent of the Injune Creek Group, and at least two aquifers in the Orallo Formation, supply many bores at rates up to 800 gallons per hour. A feature of the Injune Creek aquifers is that they are commonly associated with coal (at least, according to the drillers' logs).

Oil and gas

In this area (see also "Previous Investigations" and Table 2) exploration, and prospective targets, are virtually confined to the west and south where there are reasonably thick sedimentary sequences. In the Mimosa Syncline to the west there is probably 15,000 feet of Permian to Jurassic section. In all, 18 holes have been drilled on the Sheet, and no worthwhile hydrocarbon shows have occurred. Most of these were sited on or near small anticlines related to faulting in the flanks of the Mimosa Syncline.

The two early holes, Murilla Oil Co. No.1 (Boyanda) and Condamine Speculation No.1, reported hydrocarbons, but probably most of these shows were methane from the coals of the Jurassic Injune Creek Group. Most of the drilling has been done by Union-Kern-A.O.G. between 1963 and 1966, following detailed seismic work, the holes being aimed at both structural and stratigraphic traps. The only hydrocarbon show in all these holes was gassy water in the Precipice Sandstone of U.K.A. Mackie No.1 in the south.

In adjacent areas hydrocarbon shows have been found in the Permian Back Creek Group and Blackwater Group in U.K.A. Burunga No.1, and 400 barrels of oil per day was produced from a sand in the Lower Jurassic Evergreen Formation in U.K.A. Conloi No.1. Oil and gas were produced from the Lower Jurassic Precipice Sandstone in U.K.A. Bennett No.1, 15 miles south of the Chinchilla Sheet area.

The only certainly marine beds in the area are in the Back Creek Group. It is possible that parts of the Evergreen Formation are also marine. Thus the likely source beds for hydrocarbons in the area are these two units. Any porous and permeable beds in the sedimentary sequence could contain oil. The most obvious reservoir sequence is the Precipice Sandstone, and clean sands in the Evergreen Formation are also likely reservoirs. If not held in structural or stratigraphic traps, hydrocarbons could have migrated up dip and escaped from the Lower Jurassic sands which crop out in the north and east. Although these sands generally appear clayey, that some of them are porous and permeable is shown by the considerable amount of brackish water produced from them by bores.

The authors believe that there could be hydrocarbon accumulations in small fields in this area, but the drilling already completed, with its complete lack of shows, is discouraging.

Bentonite

A deposit of good quality bentonite was discovered by the party in a scarp north of Miles on the Miles/Wandoan Road (GR299725). This discovery is reported in detail in Exon and Duff (1968) and was the subject of a press statement in July by the Minister for National Development and the Queensland Minister for Mines. Five seams up to five feet thick crop out in the scarp and another on the plain 1000 feet to the west. Bentonite in the same general interval was also intersected in shallow drill holes Chinchilla 1, 2 and 2A, 500 yards south of the scarp (see Fig.8).

These outcrops are part of the Upper Jurassic sequence in which good quality bentonite was found near Yuleba further west (Duff and Milligan, 1967). It is not clear as yet whether this new deposit belongs in the uppermost Injune Creek Group or the lowermost Orallo Formation.

The bentonites are ash-fall deposits which have been preserved only in backswamps, away from Jurassic stream channels. They may be widespread in the Upper Jurassic sequence of the Surat Basin. Chemical and physical analysis has shown that the bentonite is sodium montmorillonite, and has potential as a base for drilling mud and possibly for pelletizing iron ore.

Coal

Several attempts have been made to establish coal mines on the southern part of the Chinchilla Sheet area, along the Brisbane-Roma railway. Coal occurs commonly throughout the vertical extent of the Injune Creek Group, but in general the seams are fairly narrow (mostly less than 10 feet) and consist of finely interbedded bands of coal and shale. That the coal is high in volatiles is shown by the numerous reports of occurrences of occluded coal gas (for example, see Gray, 1967). However, occurrences are scattered, and the volumes of gas are not economically significant.

Clay

A brickworks at Chinchilla utilizes clays of a deep weathering-profile developed on Orallo or Injune Creek sediments (MR357683). A report by Hueber & Holland (1952) concluded that the clays were suitable for the manufacture of extruded and wire cut bricks and agricultural pipes. In the same investigation (Hueber & Holland, op.cit.), clays from deeply weathered probable Evergreen sediments on Waterloo Creek near Durong and deeply weathered Evergreen clays from Burra Burri were examined; the former were found suitable for bricks, the latter for bricks and pottery.

Road Metal

The Wambo Shire Council quarries basalts on the southeastern corner of the Chinchilla Sheet area. Two major quarries are in operation: King's Pit north of Bell (MR453660) and Malakoff Quarry (MR431654) east of Jimbour. The basalt in this area was extruded in at least three separate flows with intervening periods of weathering, so that the vesicular tops of the flows are more decomposed, and act more as a soil than as a basalt. The vertical extent of the unweathered basalt varies erratically, and consequently the amount available for economic quarrying is quite small compared with the total areal extent of the flows.

Iron ore

An investigation of the potential of the oolitic ironstone member was carried out by Consolidated Zinc Pty Ltd in the area immediately north of the Chinchilla Sheet area and reported on by Urquhardt (1962). The iron content of the oolitic limonite itself averages 40 percent Fe. An exploration programme over nine months included reconnaissance and detailed mapping, and culminated in the drilling of 34 diamond drill holes to test the deposit from Mooranga Holding to Kilbeggan Holding (Mundubbera Sheet). Ore reserves in the Dawsonvale-Cockatoo area were estimated at 139 million tons of ore, with an average thickness of 4.7 feet and overburden of 6 feet, and an average grade of 37.5 percent iron. They were not estimated in the Kilbeggan area where overburden averages 15 feet.

Beneficiation tests were not successful and the deposits were not considered economic in the Mundubbera Sheet area. As Urquhardt had reconnoitred the Chinchilla Sheet area before concentrating on the area to the north, it is unlikely that economic deposits exist here. It is possible though that equivalent deposits exist in the east, where the oolitic ironstone member is appreciably thicker. Two 3 foot seams of ironstone 10 feet apart were seen in a scarp near the "Yarrol Thrust" (416751) and better prospects could exist elsewhere. However, only a drilling programme could prove them, and after the discouraging results in the north, this would not be justified at the present.

Copper

Just south of the road between Allies Creek and Boondooma Homestead there is a rock crusher. On a hill to the south of it (GR419761) are numerous diggings. Local residents say that this was once a worked copper mine, but there are no records of it at the Queensland Mines Department.

The country rocks consist of a variety of Carboniferous rock types - mainly very fine grained sheared sediments and ?tuffs. A distinctive red mudstone found only in the mullock heaps contains malachite and azurite veins.

At the diggings the ground is riddled with old shafts and costeans. The deepest shaft is more than 100 feet deep, and others are 20 to 40 feet deep. Some of the shafts are timbered.

Sample SB873 from a related locality 2 miles to the north (GR416764) consists of green very fine sandstone and siltstone veined with quartz, and rather sheared. Analysis of this (see Appendix 5) shows it to contain 6900 ppm copper.

The mineralization is almost certainly related to the adjacent granite, which has been shown to intrude the country rock in some places.

Tin

According to a local resident the creek at GR427765 has been sporadically worked for alluvial tin for many years, although no production is recorded at the Queensland Mines Department. There is an old hut and some ironware at the site. The alluvium is derived from granite which lies nearby to the south. The only outcrop in the creek at the locality is of very fine grained dark green Carboniferous volcanics.

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APPENDIX I

PETROGRAPHY OF SPECIMENS FROM THE CHINCHILLA SHEET AREA

by

A. Medvecky

About 80 thin sections and the related hand specimens of rocks from the Chinchilla area were examined petrographically -most by the author, some by Susan Windeyer. Estimates of minerals in these specimens were made without the aid of point counting.

The localities of these rocks are shown in the accompanying figure in which their registered numbers are used. The lithologies of the rocks are tabulated under stratigraphic units. A general summary of the main rock types follows the tables for some units.

Cards with more detailed descriptions, the thin sections, and the handspecimens are held at the Bureau of Mineral Resources.

CARBONIFEROUS

Field No. Registered No. Run/Photo	Grain size	Quartz	Feldspar	Mica	Rock fragments	Opaque Minerals	Clay Minerals	Other Minerals	Matrix	Classification	Hand Specimen
141 6758/325A 2/5146	0.5 - 2.0mm	1%	20% K Feldspar Plag	Minor Biotite	5% largely chert	Minor magnetite	-	-	75% Tuffaceous with some shards	Tuff or reworked tuff	Medium grained greyish green-purple metamorphosed sheared tuffaceous white arenite.
141 6758/3258 2/5146	1.5mm	-	20% K Feldspar >> Plagioclase	-	75% Acid Inter- mediate volcs.	3% Magnetite	5% Sericite	-	-	Sheared lithic sandstone	Very coarse grained light-medium light-grey sheared and metamorphosed labile arenite.
201 6758/350 3/5143	0.5mm fine matrix	-	8% K Feldspar	7% Musc.4% Chlo.3%	-	5% Magnetite	-	2% Calcite 1% Glass 1%	77% Feldspar Quartz	Porphyry	Fine grained, medium dark grey porphyritic rock
218 6758/351 2/5150	0.5 -0.25mm	5-10%	40% K Feldspar Some.plag.	10% Chlorite	-	3% Magnetite	-	35% Hornblende	-	Hornblende Microdiorite	Fine grained greyish green sheared metamorphosed rock
273 6758/342 1/5030	0.7mm.Very fine matrix	10%	25% Oligoclase	Musc.1%	-	2% Pyrite	-	Pyroxene 3% Calcite 2%	50% + 5% Glass	Ignimbrite (Welded tuff)	Very fine dusty green rock with white phenocrysts.
289 6758/358 1/5030	0.4mm Very fine matrix	20%	20% K Feldspar	-	40% Volcanics?	10% Hem/Lim 8% Mag. 2%	4% Sericite	Glass	3%	Tuffaceous lithic sandstone or tuff	Fine to medium grained metamorphosed tuffaceous labile sandstone
1431 6758/362A 1/5026	1.00mm fine matrix	25%	30% Oligoclase	8% White 3% Chlo. 5%	20% Volcanics	2% Magnetite	Minor Sericite	1% Zircon	10%	Porphyry	Medium grained medium bluish grey porphyritic rock
1431 6758/362B 1/5026	0.2mm	5%	7% K Feldspar Some plag.	-	10% mudclasts	4% Limonite	3% Sericite	-	70%	Tuffaceous siltstone	Very fine grained dark grey tuffaceous siltstone.
1431 6758/362C 1/5026	0.1 - 1.8mm	-	50% Andesine;some K Feldspar	10% Chlorite	-	8% Magnetite	5% Sericite	25% Pyroxene	-	Pyroxene basalt	Medium grained greyish green basalt with feldspar phenocrysts
1130 6758/866 1/5038	5.0 - 8.0mm very coarse	0.05- 0.5mm	0.7 - 2.5mm aver. 1mm K Feldspar	-	Volcanics > sediment.	-	-	-	Micro- crystal	Volcanic breccia	Very coarse greyish black volcanic breccia.

Appendix 1 (Cont.)

CARBONIFEROUS .. (Cont.)

Field No. Registered No. Run/Photo	Grain size	Quartz	Feldspar	Mica	Rock Fragments	Opaque Minerals	Clay Minerals	Other Minerals	Matrix	Classification	Hand specimen
1131 6758/867 1/5038	Very fine Fine	7-10%	80% Plagioclase	-	-	10-13%	Sericite Kaolinite	-	-	(Microcrystalline) tuff	Very fine massive black basalt with reddish brown Fe mineral (hematite).
1131 6758/867 1/5038	Coarse - very coarse	0.5mm	0.3 - 0.8mm Plag. K Feldspar	Chlorite	Sedim.1.0- 3.0mm.Volcs. up to 5mm.	Hematite	Sericite	-	Microcrystal Quartz	Volcanic breccia	Very coarse strongly weathered greyish black (fresh) yellowish brown (weathered) volcanic breccia.
1171 6758/868 1/5034	Medium - Coarse	10-15%	20% plagioclase K Feldspar	-	20% volcanics sedim.	3% magnetite	Sericite Kaolinite	7% Oolites	35 - 40% Quartz Chalcedony	Oolitic labile arenite (greywacke)	Medium-coarse grained medium grey labile arenite.
1226 6758/869 1/5034	Very coarse up to 3.5mm	0.1 - 1.5mm	-	-	Quartzite 0.5-1.0mm	-	-	Calcite	-	Sandy limestone	Very coarse grained crystalline medium dark grey sandy limestone
1252 6758/870 1/5034	Very coarse	0.05 - 2.5mm	-	-	Sedim. 0.3- 17.0mm	Hematite	-	-	Quartz	Breccia	Very coarse red purple breccia. Rock fragments of quartzite, siltstone, quartz in microcrystalline quartz matrix.
1275 6758/875 4/5051	Very fine	10-15%	5% plagioclase	-	7% Sedim.	10% Hematite	-	-	65% Quartz Feldspar?	Labile arenite (sandstone)	Very fine laminated dark grey-dusky red sandstone
						METAMORPHICS					
1203 6758/850 3/5137	Medium	35%	43%	20% biotite	-	Minor Magnetite	-	10% Zircon	-	Biotite schist	Medium grained, medium grey extremely biotitic microgranodiorite.
1214 6758/851 4/5055	Fine-medium	50%	18%	18% Bio.15% Musc.3%	-	7% Magnetite	7% Sericite	Pyroxenes ?	-	Biotite-albite- quartz-phyllite	Fine to medium grained olive grey-brownish grey thinly bedded phyllite with abundant mica.
1222 6758/852A 4/5055	Medium	35%	50% K Feldspar Albite	13% Bio 10% Musc.3%	-	Minor magnetite	1% Chlorite	Minor zircon	-	Quartz-feldspar- biotite schist	Medium grained,bedded, foliated; medium light to brownish grey quartz - feldspathic-biotite schist.
1222 6758/852B 4/5055	Medium	35%	50% K Feldspar Some plag.	15% Biotite	-	Minor magnetite	-	-	-	Quartz-feldspar- biotite schist	Medium grained, foliated.reddish brown-brownish grey quartz-feldspathic mica schist.
1239 6758/853 4/5051	Medium	45%	35% K Feldspar Some plag.	20% Bio .10% Musc.10%	-	1% magnetite	-	Minor zircon	-	Quartz-feldspar- mica schist	Medium grained thinly foliated mica schist.
1240 6758/854 4/5051	Medium- coarse	40%	50% K Feldspar Plagioclase	6-8% Bio. 5-7% Musc. 1%	-	Minor	3% chlorite	-	-	Quartz-feldspar- biotite gneiss.	Medium to coarse grained extremely foliated light grey-brownish grey biotite gneiss.
714 6758/968 6/5060	Medium coarse	15%	75% Oligoclase	7-8% Biotite	-	½% Magnetite (Apatite)	2 - 2.5% Sericite	2% zircon	-	Feldspar-biotite schist	-

Appendix 1 (Cont.)

PALAEOZOIC DYKES

Field No. Registered No. Run/Photo	Grain size	Quartz	Feldspar	Mica	Dark Minerals	Opaque Minerals	Clay Minerals	Other Minerals	Matrix	Classification	Hand Specimen
16 6758/302 1/5018 Auburn Granite	Medium	+	63% Plag.	-	30% chlorite	7% magnetite	-	-	-	Diorite	Medium grained greyish green diorite
20 6758/305B 1/5018 Auburn Granite	0.5 - 2.3mm fine matrix	-	Andesine oligoclase	-	-	5% magnetite	-	Zircon	-	Porphyry	Greenish red purple-dark greenish grey porphyry. Feldspar in fine matrix.
166 6758/329B 1/5030 Carboniferous	fine-medium	-	65% Plag.	-	30% Hbd.	-	-	-	-	Hornblende andesite	Medium grained greyish green andesite.
166 6758/329C 1/5030 Carboniferous	medium- coarse	-	65% Andesine	-	30% Pyroxene Chlorite	5% magnetite	-	-	-	Pyroxene andesite	Medium grained green porphyritic rock, plagioclase-chlorite-andesite.
1375 6758/3706 5/5197 Boyne R. Granite	0.5 - 2.5mm very fine matrix	0.5 - 1.2mm	0.5 - 2.5mm K Feldspar Some plag.	?	-	-	-	-	Quartz Feldspar Mica	Porphyry	Very pale orange porphyritic rock, Quartz, feldspar in very fine matrix
334 6758/806 2/5158 Boyne R. Granite	0.5 - 3.0mm very fine matrix	0.5- 1.5mm Individual grains and chalcedony	0.5 - 3.0mm	Mica in matrix	-	-	-	-	Quartz Feldspar Chlorite Mica	Spherulitic acid dyke rock	Pink and light red feldspar; watery quartz in greyish green matrix
1105 6758/863 1/5034 Boyne R.Granite	0.3 - 3.5mm very fine matrix	5%	10% K Feldspar plagioclase	Muscovite in matrix	-	-	-	-	85% Quartz Feldspar Muscovite	Porphyry	Very pale orange-greyish orange porphyritic rock. Quartz, feldspar in very fine matrix.
1149 6758/864 1/5040 Boyne R.Granite	1.00 - 1.5mm very fine matrix	Chalc. spherulites	In matrix	-	-	-	-	-	Quartz Feldspar	Spherulitic acid dyke rock.	Very fine grained greyish orange spherulitic rock.
1156 6758/865 1/5158 Boyne R.Granite	0.5 -2.0 mm	Volcanic Quartz Chalc.	K Feldspar	-	-	-	-	-	-	Spherulitic acid dyke rock	Greyish red purple spherulitic rock with euhedral quartz and pink feldspar.

GRANITE

Field No. Registered No. Run/Photo	Grain. size	Quartz	Feldspar	Mica	Dark Minerals	Opaque minerals	Clay Minerals	Other Minerals	Matrix	Classification	Hand Specimen
20 6758/305 1/5018 Auburn Granite	Coarse - Very coarse	25%	40% K Feldspar Plagioclase	Minor chlorite biotite	-	5% Hematite Magnetite	Kaolinite	-	30% Quartz feldspar	Granite porphyry	Coarse-very coarse pink granite porphyry. Feldspar, quartz, mica.
20 6758/305 1/5018 Auburn Granite	1.5mm very fine matrix	8%	17% Mainly oligoclase	5% - Bio 1% (gives chlorite 4%)	-	3% Magnetite	3% Sericite	8% - 1% zircon 7% acid volcs.	55%	Acid porphyry	Medium grey porphyry with watery quartz, pale pink feldspar.
62 8757/315 1/5022 Auburn Granite	Coarse	5%	65% Plagioclase	-	30% Hbd	-	Minor sericite	-	-	Hornblende diorite	Coarse grained green rock consists of feldspars and hornblende
1369 6758/368 5/5197 Boyne R. Granite	Coarse	35%	55% K Feldspar Plag.	5% Musc. 3% Bio. 3%	-	2% Hematite	1% Sericite	-	-	Granite	Very coarse grained yellowish orange granite
1146 6758/855 1/5040 Boyne R. Granite	Coarse	25%	40% K Feldspar Plag.	15% Bio. 10% Chlo. 5%	5% Hbd	-	5% sericite	Minor zircon	-	Hornblende-biotite Granite	Coarse grained granite with pink feldspar and green mafics - Bio, Hbd.
1182 6758/856 3/5137 Boyne R, Granite	Coarse	30%	35% K Feldspar Plag.	20% Bio. 15% Chlo. 5%	7% Hbd	-	3% sericite	2% zircon	-	Hornblende-biotite Granite	Coarse grained granite, quartz, feldspar, mafics -Bio, Chlo., Hbd.
1245 6758/857 4/5051 Boyne R. Granite	Medium	35%	45% K Feldspar Plag.	15% Biotite Chlorite	-	2% Magnetite	-	Minor zircon	-	Biotite granodiorite	Medium grained grey granodiorite with abundant biotite.
1105 6758/858 1/5034 Boyne R. Granite	Medium	60%	30% K Feldspar > Plag.	8% Chlorite	-	2% Magnetite	-	-	-	Granite	Medium grained white granite with chlorite, some magnetite
1107 6758/859 1/5034 Boyne R, Granite	Coarse - very coarse	20%	47% K Feldspar some plag.	-	-	3% Magnetite	Sericite in matrix	-	30% Quartz sericite	Granite porphyry	Coarse-very coarse pink granite porphyry with large K Feldspar.
1109 6758/860 1/5034 Boyne R. Granite	Coarse - very coarse	40%	50% K Feldspar	7% Biotite Chlorite	-	3% Magnetite	-	-	-	Granite	Coarse-very coarse pinkish grey granite. K Feldspar, quartz, chlorite.
1230 6758/861 1/5034 Boyne R. Granite	Coarse - very coarse	43%	55% K Feldspar	-	-	1% Magnetite	-	-	-	Granite	Coarse- very coarse greyish-orange-pink leucocratic granite.
1256 6758/862 1/5034 Boyne R. Granite	Coarse - very coarse	40%	50% K Feldspar Plag.	-	-	5% Magnetite	5% Kaolinite	-	-	Granite	Coarse- very coarse greyish-orange-pink leucocratic granite- weathered.

Field No. Registered No. Run/Photo	Grain size	Quartz	Feldspar	Mica	Dark minerals	Opaque Minerals	Clay Minerals	Other Minerals	Matrix	Classification	Hand specimen
1244 6758/874 4/5051 Boyne R. Granite	Medium	50%	35% Plagioclase K Feldspar	10-15% Biotite (Chlorite)	-	-	-	Minor zircon	-	Biotite granite	Medium grained light grey granite with abundant biotite.
TERTIARY VOLCANICS 1											
67 6758/317A 1/5022 "Round Mountain"	0.6mm	-	-		20% Olivine 10% Pyroxene 10%	5% Magnetite		5% Chlorite	70% Plagioclase	Pyroxene-olivine microgabbro	Medium grained black basalt
67 6758/317C 1/5022 "Round Mountain"	0.8mm Very fine to fine matrix		Minor plagioclase		13% Olivine 10% Pyroxene 3%	7% Magnetite		5% Chlorite	70% Plagioclase Pyroxene Olivine; Chlorite	Olivine basalt	Very fine-fine grained black basalt-gabbro
170 6758/330 1/5030	Very fine	-	-		Altered pyroxene	-	-	-		Soil profile? on volcanics	Very fine light red purple-greyish red purple weathered rock with white fine threads
357 6758/366 5/5201 Pipers Dodge Mt.	Coarse	-	Andesine		Pyroxene Olivine	-	-		Andesine	Olivine-pyroxene gabbro	Coarse grained black igneous rock, plagioclase, pyroxene, olivine
1313 6758/621 2/5126	0.1-1.0mm	-	30% plagioclase		27% Pyroxene 15% Olivine 12%	10% Magnetite		10% Chlorite	25%	Pyroxene-olivine basalt or micro-gabbro	Fine grained black basalt
1326 6758/809A 2/5158	0.1-0.75mm	8% Chalcedony	-		20% Pyroxene	4% Magnetite	-		65% volcanic glass	Altered fine tuff	On weathered surface moderate-brown earthy rock - altered tuff contains worm tubes
TERTIARY VOLCANICS II											
1326 6758/809B 2/5158	0.1-0.2mm	-	15% plagioclase		28% Pyroxene	7% Limonite Hematite		15% Chlorite	25%	Altered pyroxene basalt	Very fine grained medium dark grey weathered basalt. Underlies 809A
651 6758/975 7/5147	0.1-0.2mm	-	40% plagioclase		27% Pyroxene 23% Olivine 4%	6% Magnetite		Minor chlorite	25%	Altered olivine-pyroxene basalt	No specimen
- 6758/981 -	0.7mm fine matrix	-	35% plagioclase		10% Pyroxene	10% Hematite		25% Chlorite	20-25%	Altered pyroxene basalt	Fine grained red purple altered basalt with phenocrysts of Feldspar, Chlorite
PRE BASALTIC REGOLITH											
667 6758/951 8/5044	0.7mm	5%				90% Hematite Limonite Magnetite				Soil profile ? (Iron rich mud)	Reddish brown hematitic medium grained rock
667 6758/951B 8/5044			5-8% Feldspar and some rock fragments			Hematite			90% Hematite	Soil profile ?	Reddish brown rock with earthy appearance and very pale orange-orange pink Feldspar and rock fragments

Appendix 1 (cont.)

LOWER EVERGREEN FORMATION (Jle_1)

Field No. Registered No. Run/Photo	Grain size	Quartz	Feldspar	Mica	Rock fragments	Opaque Minerals	Other Minerals	Clay Minerals	Matrix	Classification	Hand specimen
30 6758/307 1/5022	Medium	40%	15% K.Feldspar Plagioclase	Minor muscovite	25% Sedim. > volcanics	-	Minor zircon	20% Kaolinite	-	Feldspatho -lithic-arenitic (sandstone)	Medium grained, massive, yellowish-orange sandstone.
55 6758/312 1/5018	Medium	30%	15% K.Feldspar Plagioclase	-	25% Sedim. some volcanics	7% Hematite	Minor zircon	3% Kaolinite	20% Quartz.felds. clay	Feldspatho-lithic arenite (greywacke)	Medium grained, unsorted, friable, yellowish grey, greywacke (stratified).
91 6758/318A 1/5026	Very fine	15%	10% K. Feldspar	12% Muscovite	3% Sedim.	-	Minor 1% zircon	10% Kaolinite	60% Quartz clay	Feldspathic arenite sandstone	Very fine, massive laminated, very light grey sandstone.
155 6758/327C 2/5154	Coarse	35%	20% K.Feldspar	10% Muscovite	In matrix	Minor Hematite (Mag?)	Minor zircon	Kaolinite in matrix	35% Quartz rock fragment clay	Feldspathic arenite (arkose)	Coarse grained, weathered, grey-greyish purple (Fe) arkose
77 6758/331 1/5034	Medium	75-80%	15-20% K.Feldspar	-	2-3% Sedim.	-	-	-	5% Quartz	Feldspathic sublabile arenite (sandstone)	Medium grained, massive light grey (reddish brown when weathered) sandstone.
191 6758/334 1/5026	Very fine	75%	1-2%	5% Muscovite Chlorite	2-3% Sedim.	Minor Hematite	-	Minor kaolinite	15% Hematite quartz	Quartzose sandstone	Very fine grained. sugary yellowish, friable. orange-reddish brown sandstone.
287 6758/356 1/5030	Medium	40%	-	-	45% Volcs.40% Sedim. 5%	4% Hematite limonite	-	In matrix	10% clay	Lithic arenite (greywacke?)	No specimen
287 6758/356 1/5030	Medium	35%	5%	3% Muscovite	40% Volcs. 25% Sedim.15%	3% Hematite limonite	2% zircon	In matrix	20% clay	Lithic arenite (greywacke)	No specimen

EASTERN EVERGREEN FORMATION (Jle_e)

Field No. Registered No. Run/Photo	Grain size	Quartz	Feldspar	Mica	Rock fragments	Opaque Minerals	Other Minerals	Clay Minerals	Matrix	Classification	Hand specimen
1347 6758/364 5/5201	Very fine fine	70%	Minor K.Feldspar	3% Muscovite	10% Sedim.	5% Magnetite	Minor rutile zircon	In matrix	10% clay	Lithic sublabile arenite(sandstone)	Very fine, friable greyish orange sandstone with muscovite.
1440 6758/369 4/5047	Fine	20%	4% Plagioclase	20% Muscovite	14% Volcs.8% Sedim.6%	-	-	In matrix	40% clay	Lithic arenite (greywacke?)	No specimen
691 6758/974 8/5054	Medium	60%	-	½% Green Bio.	12% Sedim.7% Volcs.5%	Hematite Limonite in matrix	3% zircon	-	20% Hematite Limonite	Lithic sublabile arenite (sandstone)	No specimen
- 6758/980 -	Fine-medium	40%	1%	-	40% Volcs.35% Sedim. 5%	4% Hematite Limonite	2% zircon	In matrix	10% clay	Lithic arenite (sandstone)	Fine-medium grained, friable, yellowish grey sandstone.

APPENDIX 1 (contd)

OOLITIC IRONSTONE MEMBER OF EVERGREEN FORMATION (Jlo)

Field No. Registered No. Run/photo	Grain size	Quartz	Oolites	Cement	Classification	Hand specimen
13 6758/300 1/5018	Oolites 0.5-2.5mm	-	Haematite or limonite	Limonite	Oolitic ironstone	Laminated to thinly bedded oolitic ironstone, sandstone and siltstone
26 6758/306 1/5022	Oolites about 1mm. Quartz grns 0.2mm	5%	Haematite or limonite	Limonite	Oolitic ironstone	Greenish, medium bedded f. sst.; concretionary ironstone, some oolitic. 3 oolitic horizons
BMR Chinchilla No.4. Core 4 Depth 216'11½" 1/5014	Oolites 0.5-0.8mm in fine cement	5%	Brownish-black siderite	Calcite	Oolitic carbonate rock	Dark brown soft oolitic ironstone interbedded with mudstone

HUTTON SANDSTONE

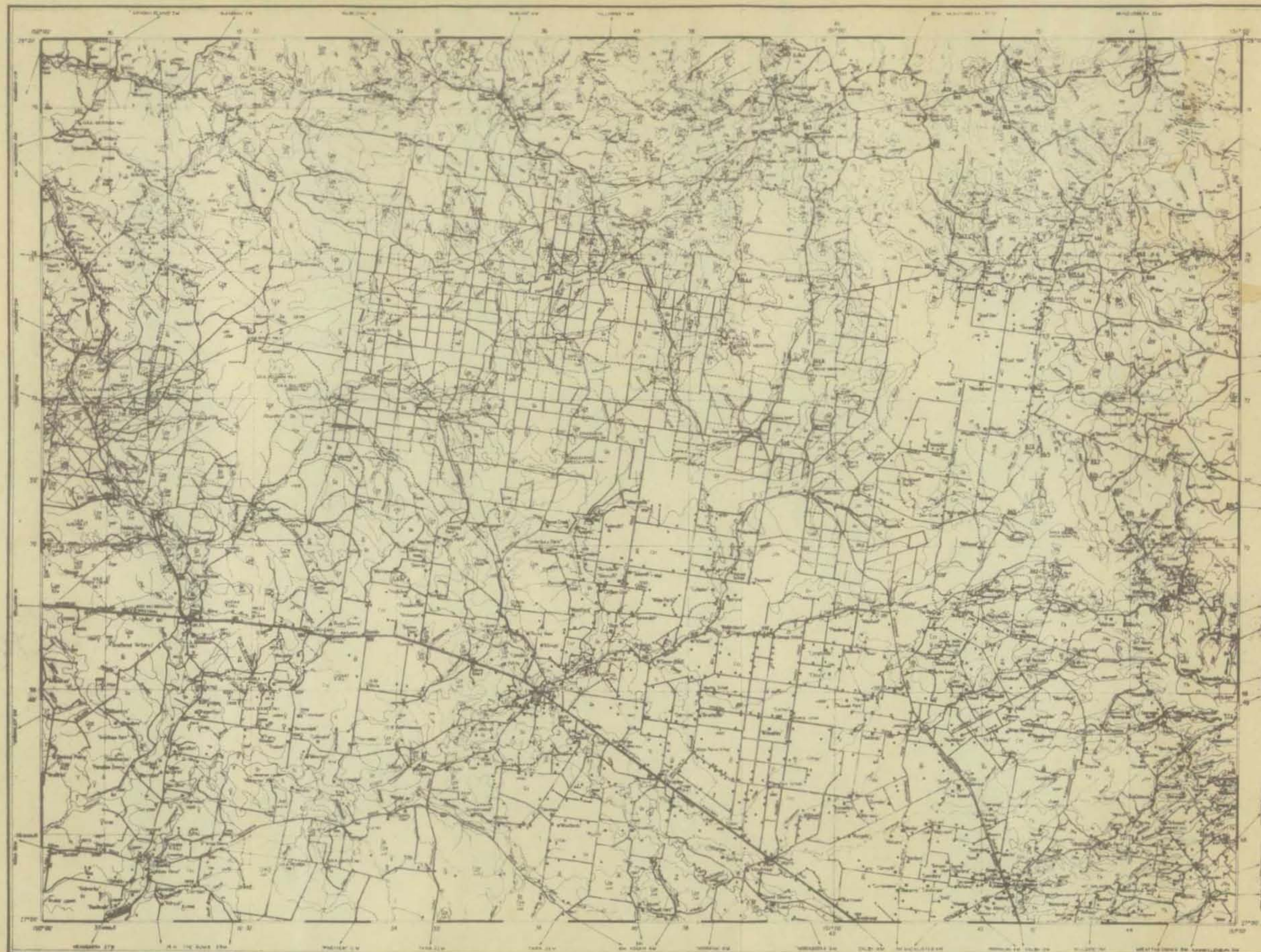
Field No. Registered No. Run/photo	Grain size	Quartz	Feldspar	Mica	Rock fragments	Opaque Minerals	Other Minerals	Clay Minerals	Matrix	Classification	Hand specimen
37 6758/308 1/5014 Upper	Very fine	40%	20% K Feldspar Plagioclase	10% Muscovite (Chlorite)	In matrix covered by clay	5% Magnetite; some organic material	-	Kaolinite in matrix	25% rock frag. kaolinite	Feldspathic arenite (sandstone)	Very fine, friable, brownish grey-olive grey sandstone
45 6758/310 1/5010 Upper	Very fine	40-45%	5-7% K-Feldspar Plagioclase	2-3% Muscovite Bio-leached Chlorite	5-7% Sedim. Volcanics	10-15% Hematite	-	Minor sericite in matrix	25% Quartz feldspar clay	Labile arenite (sandstone)	Very fine grained reddish-brown sandstone
51 6758/311 1/5010 Upper	Medium	45%	10% K Feldspar Some Plag.	2% Muscovite	15% Sedim. Some volcs	10% Hematite (Limonite?)	-	Kaolinite in matrix	15% Quartz Clay	Feldspatho-Lithic arenite (greywacke)	Poorly sorted, medium grained, friable, dark yellowish-orange greywacke
109 6758/320B 3/5147 Lower	Fine	50%	-	1-2% Muscovite (Chlorite)	10% Sedim. > Volcs	7% Magnetite	1% Zircon	Sericite in matrix	30% quartz, chalcedony, feldspar, clay	Lithic labile arenite (greywacke)	Fine grained, well sorted, massive white sandstone
137 6758/327A 2/5146 Lower	Fine	35%	5-7% Plagioclase > K Feldspar	2% Muscovite	15% Sedim.	2-3% Magnetite	Minor zircon	-	40% calcite	Feldspatho-Lithic arenite (sandstone)	Fine grained friable yellowish grey sandstone
137 6758/324B 2/5146 Lower	Fine-medium	40%	10-15% Plagioclase K Feldspar	1-2% Muscovite	15% Sedim. > volcs	Hematite in matrix	-	Clay in matrix	30% Hematite clay	Labile arenite (sandstone)	Fine to medium grained, friable greyish orange sandstone
237 6758/338 4/5039	Fine-coarse	80%	-	Minor muscovite Biotite, Chlorite	10% Sedim.	5% Magnetite	Minor zircon tourmaline	Clay in matrix	5% clay	Quartzose arenite (Basal sandstone)	Fine and coarse grained very light grey basal sandstone with orange stains
281 6758/353 1/5014	Medium	35%	5%	7% Muscovite	25% Sedim. 15% Volcs 10%	3% Limonite	3% Zircon	Clay in matrix	20% clay	Lithic arenite (greywacke)	No sample

APPENDIX 1 (contd)

HUTTON SANDSTONE (contd)

Field No. Registered No. Run/photo	Grain size	Quartz	Feldspar	Mica	Rock fragments	Opaque Minerals	Other Minerals	Clay Minerals	Matrix	Classification	Hand specimen
1428 6758/361 2/5138	Fine	25%	5%	8% Muscovite	20% Sedim. 10% volcs 10%	3% Magnetite Hematite	1% Zircon	Clay in matrix	35% clay	Lithic arenite (sandstone)	Fine, friable, pinkish grey sandstone with abundant Musc and Fe stains
1360 6758/367 5/5201 Lower eastern	Fine-medium	45%	-	5% Bio-leached Muscovite	15% Sedim. (Volcs ?)	5% Magnetite Hematite	1% Zircon	Clay in matrix	30% rock frag. Quartz, clay	Lithic arenite (sandstone)	Medium grained, friable, very light grey-pinkish grey sandstone with mica, Fe.
INJUNE CREEK GROUP											
1389 6758/376 3/5171 Uppermost	Very fine - Fine	35%	10% K Feldspar Plagioclase	1-2% Muscovite	10-15% Sedim. > volcanics	7% Magnetite	<1% Zircon	Clay in matrix	30% Calcite clay	Feldspatho-lithic arenite (sandstone)	Very fine grained friable, light grey sandstone with Fe yellowish brown stains
278 6758/352 1/5066 Low	Fine - Medium	10%	8% Plagioclase > K Feldspar	2% White mica	19% Volcs 15% Sedim. 4%	4% Magnetite	-	Clay in matrix	55% calcite clay	Feldspatho-lithic arenite (sandstone)	Fine-medium grains, massive, moderate yellowish brown sandstone with abundant magnetite clay
ORALLO FORMATION											
1390 6758/377A 3/5171 (possibly Injune Creek)	Fine - Medium	25%	15% K Feldspar Plagioclase	Minor muscovite	20% Sedim. Volcs	10% Hematite	< 1% Zircon	Kaolinite	30% Chalcedony Calcite Qtz., Plag.	Feldspatho-lithic arenite (greywacke)	Medium grained, friable, poorly sorted greyish orange greywacke, abundant Fe, rock fragments
728 6758/979 7/5119	Coarse - Very coarse	40%	-	-	11% Sedim. 8% Volcs 3%	Minor Fe	2% Zircon	In matrix	47% iron rich clay	Quartzose arenite (sandstone)	Coarse-very coarse greyish yellow arkose
CHINCHILLA SAND											
730 6758/976 5/5119	Medium	30%	10% Plagioclase	-	15% Sedim. 10% Volcs 5%	5% Limonite Hematite	1-2% Zircon		35% calcite	Feldspatho-lithic arenite (sandstone)	No specimen

SPECIMEN LOCALITY MAP



• 613 Surat Basin number SB.613

Letter symbol reference on 1:250,000 sheet

0 5 10 miles

Scale 1:500000

G56/A9/17

To accompany Record 1968/53

APPENDIX 2

PRELIMINARY NOTES ON THE PALYNOLOGY OF SHALLOW HOLES DRILLED IN THE CHINCHILLA SHEET AREA

by

D. Burger

Introduction

Palynological examination of core samples from BMR Chinchilla Nos. 3, 4, 5 and 7 Scout Holes enabled a study of the succession of microfloras in the upper Evergreen Formation and Hutton Sandstone to be made. Lower Jurassic spore unit J2 and Lower to Middle Jurassic units J3-4 were recognized. J4 may be a valid spore unit in its own right.

TABLE 1: RELATIONSHIP OF STRATIGRAPHY TO PALYNOLOGY

Chinchilla Bores	Core	Sample (MFP)	Depth	Lithology	Spore Units	Acritarchs
3	1	4677	50'10"	Injune Creek Group	J4	
	4	4680	265'	Hutton Sst	J4	
7	1	4683	108'2"	Hutton -	J3	
	2	4684	198'11"	Evergreen	J3	
	3	4674	277'4"	(undiff.)	J3	
5	1	4673	93'2"	Evergreen Fm	J2-3	
	3	4672	271'3"		J2?	
4	2	4691	106'	Evergreen Formation	J2	
	3	4692	170'8"		J2	x
	4	4693	216'		J2	x

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APPENDIX 3

SHALLOW STRATIGRAPHIC DRILLING, ROMA AND CHINCHILLA SHEET AREAS, 1967

by

N.F. Exon

General

The Surat Basin Party supervised the drilling of 4 holes on the Roma Sheet, 4 on the Surat Sheet and 8 on the Chinchilla Sheet, from 29th September to 15th November, a period of 55 working days. Of these, 11 days were spent drilling on Surat and southern Roma Sheet. That part of the drilling is discussed in Thomas (1968).

This Appendix deals with 3 Roma holes and the 8 Chinchilla holes. The rig used for all but one of the holes was a Mayhew 1000, belonging to the Petroleum Technology Section; a Carey was used for the other hole. The driller was J. Keunen. 500 feet of drill pipe, a ten-foot core barrel, and equipment for drilling with mud were available. A Widco portalogger was available with electric and gamma probes, but due to various faults, as in other years (e.g. Exon, 1967), only 4 holes returned logs, and none returned a full set. In the Chinchilla Sheet area only one (resistivity) log was obtained.

Drilling

The drilling statistics are presented in the table. Logs of the Chinchilla holes are presented in this Record.

Holes BMR Roma 7 and 8 and Chinchilla 3-8 were drilled to:

(1) Obtain lithological information and wireline logs of poorly exposed and weathered formations.

(2) Intersect unit boundaries.

(3) Obtain palynological material.

Hole No.	Grid Ref.	Total Depth (feet)	Drilling (feet)	Coring (feet)	No. of cores	Core recovery Actual	%
Roma 1	153703	404	404				
Roma 7, 7a	151735	196	156	40	4	31	78
Roma 8	251710	267	217	50	5	38	76
Chinchilla, 1, 2, 2A	300725	159	15	160	16	139	87
Chinchilla 3	309762	267	227	40	4	28	70
Chinchilla 4	336763	390	340	50	5	39	78
Chinchilla 5	360734	355	315	40	4	29	72
Chinchilla 6	430696	310	280	30	3	20	67
Chinchilla 7	452652	280	250	30	3	26	87
Chinchilla 8	377650	265	235	30	3	27	90
Total		2953	2483	470	47	377	80

These holes were all moderately successful in attaining one or more of these aims. The failure of the logger, however, greatly reduced the value of holes Chinchilla 4-7, which all penetrated the same stratigraphic interval with the idea of tracing changes across the Sheet.

Holes Chinchilla Nos. 1, 2, and 2A were all drilled at the one site, to provide continuous core of a bentonite sequence discovered during the mapping. The drilling was entirely successful, the results are discussed in Exon and Duff (1968).

Hole Roma No. 1, first drilled in 1967 (Exon, 1967) was redrilled to allow wireline logs of this continuously cored hole to be run. This was successful.

Examination

Cores and cuttings were examined either at the well site, or later with a binocular microscope. Cores from some of the holes were palynologically examined by D. Burger (see Appendix 2).

Comments

A disappointing feature of the drilling was that it proceeded at only half the rate for the equivalent Surat Basin drilling in 1966 (see Exon, 1967). The average time for a typical 300-foot hole with 40 feet of core was about 4 days (including perhaps ½ day travelling). This was largely due to trouble with the rig motor.

The other disappointment was the portalogger which performed very poorly. This sophisticated piece of apparatus is often impossible to fix in the field and I recommend that a technician be on call in Canberra, ready to fly to the field if necessitated by breakdowns during future drilling programmes.

REFERENCES

EXON, N.F., 1967 - Shallow stratigraphic drilling, Mitchell and Roma Sheet areas, 1966. Appendix 8 in Bur. Miner. Resour. Aust. Rec. 1967/63.

EXON, N.F., and DUFF, P.G., 1968 - Jurassic bentonite from the Miles district, Queensland. Bur. Miner. Resour. Aust. Rec. 1968/49.

THOMAS, B.M., 1968 - Shallow stratigraphic drilling, Surat Sheet area, 1967. Appendix 1 in Bur. Miner. Resour. Aust. Rec. 1968/56.

APPENDIX 4.

CORE ANALYSIS RESULTS, MITCHELL, ROMA, AND CHINCHILLA SHEET AREAS.

by

P.G. Duff

Samples of cores from BMR shallow drill holes drilled in the above three 1:250,000 Sheet areas were analysed for average effective porosity, absolute permeability, average density, fluid saturation, acetone test and fluorescence. This work is complementary to that carried out by Duff on BMR drill hole cores and surface samples in the Mitchell and Roma Sheet areas. (Appendices 6 and 7 in Exon, Milligan, Casey and Galloway, 1967), and on samples from cores in BMR shallow drill holes in southern Roma Sheet and Surat Sheet (Appendix in Thomas and Reiser, 1968).

This is part of a programme of study of the aquifers in outcrop and the subsurface in the Surat Basin. A few points are worth mentioning at this stage, as regards the analyses herein. Firstly, although the Minmi Member (which contained oil in BMR Mitchell No.1 - Galloway and Duff (1966)) gave a positive acetone test in several cores, there was no fluorescence in any of them. Another factor which is of immediate significance is the permeability. This was only appreciable in the Mitchell, Roma area, in samples from the Hooray Sandstone (maximum 4000 md.), the Minmi Member (maximum 1760 md.), the Nullawurt Sandstone Member in the Merivale Syncline (maximum 2630 md.) and the Mooga Sandstone Member (maximum 814 md.). In the Chinchilla area only the Evergreen Formation in the east (maximum 463 md.), the Hutton Sandstone (maximum 48 md.) and the basal Orallo Formation (maximum 495 md.) gave significant permeabilities.

References

EXON, N.F., MILLIGAN, E.N., CASEY, D.J., and GALLOWAY, M.C., 1967 - The geology of the Roma and Mitchell 1:250,000 Sheet areas, Queensland. Bur. Miner. Resour. Aust. Rec. 1967/63. (unpubl.)

GALLOWAY, M.C., and DUFF, P.G., 1966 - Oil traces in Lower Cretaceous sediments near Mitchell, Queensland. Aust.Oil Gas J., 12(10),60.

THOMAS, B.M., and REISER, R.F., 1968 - The geology of the Surat 1:250,000 Sheet area, Queensland. Bur. Miner. Resour.Aust.Rec.1968/56 (unpubl.)

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CORE ANALYSIS RESULTS

NOTE: (i) Unless otherwise stated, porosities and permeabilities were determined on two plugs (V&H) cut vertically and horizontally to the axis of the core. Ruska porosimeter and permeameter were used with air and dry nitrogen as the saturating and flowing media respectively. (ii) Oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates are recorded as Neg., Trace, Fair, Strong or Very Strong.

WELL NAME AND NO. ROMA BMR SCOUT No. 1.   DATE ANALYSIS COMPLETED 2nd APRIL, 1968

Core No.	Sample Depth		Lithology	Average Effective Porosity two plugs (% Bulk Vol.)	Absolute Permeability (Millidarcy)		Average Density (gm/cc.)		Fluid Saturation (% pore space)		Core Water Salinity (p.p.m. NaCl)	Acetone Test	Fluorescence of freshly broken core	STRATIGRAPHIC UNIT
	From	To			V	H	Dry Bulk	Apparent Grain	Water	Oil				
1	56'3"	56'11"	Siltstone Sandstone	29	43	408	1.97	2.74	13	Nil.	N.D.	Fair*	Nil.	Minmi Member
2	64'9"	65'5"	Sandstone calc.	12	N.D.	1	2.40	2.72	N.D.	N.D.	N.D.	Neg.	Nil.	" "
3	70'0"	70'8"	"	14	N.D.	Nil	2.44	2.84	N.D.	N.D.	N.D.	Neg.	Nil.	" "
4	84'0"	84'8"	Sandstone	30	N.D.	N.D.	2.02	2.88	N.D.	N.D.	N.D.	Neg.	Nil.	" "
5	88'8"	89'4"	"	Sample	split	along	carbonaceous		laminations		unsuitable for analysis			" "
6	94'9"	95'5"	Sandstone calc.	12	Nil.	Nil.	2.49	2.82	N.D.	N.D.	N.D.	Neg.	Nil.	" "
7	104'0"	104'7"	Siltstone sandstone	27	N.D.	24	2.01	2.76	N.D.	N.D.	N.D.	Neg.	Nil.	" "
8	111'9"	112'1"	Sandstone calc.	17	Nil.	Nil.	2.36	2.83	N.D.	N.D.	N.D.	Neg.	Nil.	" "

Remarks: - * Carbonaceous laminations evident.

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CORE ANALYSIS RESULTS

NOTE: (i) Unless otherwise stated, porosities and permeabilities were determined on two plugs (V&H) cut vertically and horizontally to the axis of the core. Ruska porosimeter and permeameter were used with air and dry nitrogen as the saturating and flowing media respectively. (ii) Oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates are recorded as Neg., Trace, Fair, Strong or Very Strong.

WELL NAME AND NO. ROMA B.M.R. SCOUT No. 1

DATE ANALYSIS COMPLETED 2nd APRIL, 1968

Core No.	Sample Depth		Lithology	Average Effective Porosity two plugs (% Bulk Vol.)	Absolute Permeability (Millidarcy)		Average Density (gm/cc.)		Fluid Saturation (% pore space)		Core Water Salinity (p.p.m. NaCl)	Acetone Test	Fluorescence of freshly broken core	STRATIGRAPHIC UNIT
	From	To			V	H	Dry Bulk	Apparent Grain	Water	Oil				
9	122'3"	122'10"	siltstone sandstone	31	36	65	1.87	2.69	N.D.	N.D.	N.D.	Neg.	NIL	Minmi Member
10	125'7"	126'3"	siltstone	32	13	113	1.87	2.77	N.D.	N.D.	N.D.	Neg.	NIL	" "
11	139'10"	140'6"	sandstone	29	10	26	1.96	2.73	10	Nil.	N.D.	Fair	NIL	" "
12	144'8"	145'3"	shale	25	N.D.	N.D.	2.10	2.81	N.D.	N.D.	N.D.	Neg.	NIL	" "
13	152'1"	152'10"	shale	27	N.D.	N.D.	2.02	2.74	N.D.	N.D.	N.D.	Neg.	NIL	" "
14	163'6"	164'2"	siltstone sandstone	12	Nil	Nil	2.41	2.72	N.D.	N.D.	N.D.	Neg.	NIL	" "
15	178'8"	179'2"	sandstone	28	1240	1760	1.93	2.66	N.D.	N:D.	N.D.	Neg.	NIL	" "
16	181'3"	181'10"	sandstone	30	N.D.	547	1.85	2.66	N.D.	N.D.	N.D.	Neg.	NIL	" "

Remarks: -

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CORE ANALYSIS RESULTS

NOTE: (i) Unless otherwise stated, porosities and permeabilities were determined on two plugs (V&H) cut vertically and horizontally to the axis of the core. Ruska porosimeter and permeameter were used with air and dry nitrogen as the saturating and flowing media respectively. (ii) Oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates are recorded as Neg., Trace, Fair, Strong or Very Strong.

WELL NAME AND NO. ROMA B.M.R. SCOUT No. 1. DATE ANALYSIS COMPLETED 2nd APRIL, 1968

Core No.	Sample Depth		Lithology	Average Effective Porosity two plugs (% Bulk Vol.)	Absolute Permeability (Millidarcy)		Average Density (gm/cc.)		Fluid Saturation (% pore space)		Core Water Salinity (p.p.m. NaCl)	Acetone Test	Fluorescence of freshly broken core	STRATIGRAPHIC UNIT
	From	To			V	H	Dry Bulk	Apparent Grain	Water	Oil				
17	193'6"	194'0"	sandstone shale	27	N.D.	42	2.00	2.73	N.D.	N.D.	N.D.	Neg.	Nil.	Minmi Member
18	204'4"	204'10"	"	18	N.D.	7	2.25	2.70	N.D.	N.D.	N.D.	Neg.	Nil.	" "
19	216'9"	217'3"	sandstone	29	32	15	1.89	2.69	N.D.	N.D.	N.D.	Neg.	Nil.	" "
20	220'11"	221'5"	shale siltstone	24	Nil	N.D.	2.11	2.78	N.D.	N.D.	N.D.	Neg.	Nil.	" "
21	236'2"	236'10"	"	22	N.D.	Nil	2.18	2.79	N.D.	N.D.	N.D.	Neg.	Nil.	" "
22	244'5"	245'0"	siltstone sandstone	23	Nil	Nil	2.13	2.76	N.D.	N.D.	N.D.	Neg.	Nil.	Nullawurt Sandstone Member
23	252'3"	252'11"	sandstone	18	N.D.	Nil	2.19	2.67	N.D.	N.D.	N.D.	Neg.	Nil.	" " "
24	261'11"	262'6"	sandstone shale	22	N.D.	Nil	2.15	2.75	N.D.	N.D.	N.D.	Neg.	Nil.	" " "

Remarks: -

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CORE ANALYSIS RESULTS

NOTE: (i) Unless otherwise stated, porosities and permeabilities were determined on two plugs (V&H) cut vertically and horizontally to the axis of the core. Ruska porosimeter and permeameter were used with air and dry nitrogen as the saturating and flowing media respectively. (ii) Oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates are recorded as Neg., Trace, Fair, Strong or Very Strong.

WELL NAME AND NO. ROMA B.M.R. SCOUT No. 1. DATE ANALYSIS COMPLETED 2nd APRIL, 1968

Core No.	Sample Depth		Lithology	Average Effective Porosity two plugs (% Bulk Vol.)	Absolute Permeability (Millidarcy)		Average Density (gm/cc.)		Fluid Saturation (% pore space)		Core Water Salinity (p.p.m. NaCl)	Acetone Test	Fluorescence of freshly broken core	STRATIGRAPHIC UNIT
	From	To			V	H	Dry Bulk	Apparent Grain	Water	Oil				
25	272'1"	272'9"	sandstone	26	22	5	2.00	2.71	N.D.	N.D.	N.D.	Neg.	Nil.	Nullawurt Sandstone Member
26	279'0"	279'7"	shale sandstone	18	N.D.	N.D.	2.19	2.68	N.D.	N.D.	N.D.	Neg.	Nil.	" " "
27	290'4"	291'0"	siltstone shale	21	N.D.	N.D.	2.09	2.64	N.D.	N.D.	N.D.	Neg.	Nil.	" " "
28	296'4"	296'10"	sandstone	25	1	2	2.06	2.76	N.D.	N.D.	N.D.	Neg.	Nil.	" " "
29	300'8"	301'4"	sandstone	22	N.D.	24	2.06	2.65	N.D.	N.D.	N.D.	Neg.	Nil.	" " "
30	317'0"	317'7"	sandstone shale	25	9	24	1.99	2.67	N.D.	N.D.	N.D.	Neg.	Nil.	Kingull Member
31	323'10"	324'6"	sandstone	26	13	18	1.98	2.66	N.D.	N.D.	N.D.	Neg.	Nil.	" "
32	332'0"	332'8"	sandstone	25	25	18	1.99	2.68	N.D.	N.D.	N.D.	Neg.	Nil.	" "

Remarks: -

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CORE ANALYSIS RESULTS

NOTE: (i) Unless otherwise stated, porosities and permeabilities were determined on two plugs (V&H) cut vertically and horizontally to the axis of the core. Ruska porosimeter and permeameter were used with air and dry nitrogen as the saturating and flowing media respectively. (ii) Oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates are recorded as Neg., Trace, Fair, Strong or Very Strong.

WELL NAME AND NO. ROMA B.M.R. SCOUT No. 1 DATE ANALYSIS COMPLETED 2nd APRIL 1968

Core No.	Sample Depth		Lithology	Average Effective Porosity two plugs (% Bulk Vol.)	Absolute Permeability (Millidarcy)		Average Density (gm/cc.)		Fluid Saturation (% pore space)		Core Water Salinity (p.p.m. NaCl)	Acetone Test	Fluorescence of freshly broken core	STRATIGRAPHIC UNIT
	From	To			V	H	Dry Bulk	Apparent Grain	Water	Oil				
33	340'5"	341'0"	siltstone shale	19	N.D.	2	2.18	2.69	N.D.	N.D.	N.D.	NEG.	NIL.	Kingull Member
34	352'2"	352'10"	sandstone	22	NIL	2	2.11	2.71	N.D.	N.D.	N.D.	NEG.	NIL.	" "
35	361'9"	362'4"	"	24	2	N.D.	2.02	2.66	N.D.	N.D.	N.D.	NEG.	NIL.	" "
36	370'7"	371'3"	siltstone sandstone	24	N.D.	N.D.	2.05	2.69	N.D.	N.D.	N.D.	NEG.	NIL.	" "
37	378'2"	378'9"	siltstone shale	18	N.D.	Nil	2.16	2.64	N.D.	N.D.	N.D.	NEG.	NIL.	" "
38	392'8"	393'2"	sandstone shale	12	N.D.	Nil	2.49	2.78	N.D.	N.D.	N.D.	NEG.	NIL.	Mooga Sandstone Member
39	403'5"	403'11"	"	24	N.D.	Nil	2.04	2.68	N.D.	N.D.	N.D.	NEG.	NIL.	" " "
40	412'8"	413'2"	Sandstone	29	15	33	1.92	2.69	N.D.	N.D.	N.D.	NEG.	NIL.	" " "

Remarks: -

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CORE ANALYSIS RESULTS

NOTE: (i) Unless otherwise stated, porosities and permeabilities were determined on two plugs (V&H) cut vertically and horizontally to the axis of the core. Ruska porosimeter and permeameter were used with air and dry nitrogen as the saturating and flowing media respectively. (ii) Oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates are recorded as Neg., Trace, Fair, Strong or Very Strong.

WELL NAME AND NO. MITCHELL (BMR SCOUT) NO.1

DATE ANALYSIS COMPLETED 9TH MAY, 1968

Core No.	Sample Depth		Lithology	Average Effective Porosity two plugs (% Bulk Vol.)	Absolute Permeability (Millidarcy)		Average Density (gm/cc.)		Fluid Saturation (% pore space)		Core Water Salinity (p.p.m. NaCl)	Acetone Test	Fluorescence of freshly broken core	Stratigraphic unit
	From	To			V	H	Dry Bulk	Apparent Grain	Water	Oil				
1	54'1"	54'7"	Siltstone	*	N.D.	N.D.	1.77	*	Approx. 34	Nil	N.D.	Neg.	Nil	Minmi Member
2	132'11"	133'4"	Sandstone	35	"	"	1.73	2.68	N.D.	N.D.	"	"	"	"
3	277'2"	277'10"	"	29	1	1	1.95	2.69	"	"	"	"	"	Blythesdale Formation
4	349'8"	350'0"	"	25	N.D.	N.D.	2.04	2.71	"	"	"	"	"	"

Remarks: - * Argillaceous material present; cracks occurred on drying; results unreliable.

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CORE ANALYSIS RESULTS

NOTE: (i) Unless otherwise stated, porosities and permeabilities were determined on two plugs (V&H) cut vertically and horizontally to the axis of the core. Ruska porosimeter and permeameter were used with air and dry nitrogen as the saturating and flowing media respectively. (ii) Oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates are recorded as Neg., Trace, Fair, Strong or Very Strong.

WELL NAME AND NO. MITCHELL (BMR SCOUT) NO.2 DATE ANALYSIS COMPLETED 9TH MAY, 1968

Core No.	Sample Depth		Lithology	Average Effective Porosity two plugs (% Bulk Vol.)	Absolute Permeability (Millidarcy)		Average Density (gm/cc.)		Fluid Saturation (% pore space)		Core Water Salinity (p.p.m. NaCl)	Acetone Test	Fluorescence of freshly broken core	Stratigraphic unit
	From	To			V	H	Dry Bulk	Apparent Grain	Water	Oil				
1	54'0"	54'7"	Sandstone & Siltstone	28	N.D.	N.D.	1.95	2.70	N.D.	N.D.	N.D.	Neg.	Nil	Gubberamunda Sandstone
2	153'6"	154'0"	Siltstone & shale	27	1	"	1.95	2.65	"	"	"	"	"	Westbourne Formation
3	249'4"	250'0"	Siltstone	26	N.D.	13	1.97	2.67	"	"	"	"	"	"
		MITCHELL (BMR SCOUT) NO.3												
1	53'8"	54'1"	Siltstone	24	2	4	2.0	2.66	"	"	"	"	"	"
2	126'8"	127'3"	Sandstone	16	2	3	2.23	2.65	34	Nil	"	"	"	Springbok Sandstone Member
3	182'9"	183'4"	Shale & Siltstone	19	N.D.	N.D.	2.16	2.67	N.D.	N.D.	"	"	"	Birkhead Formation
4	247'11"	248'7"	Sandstone	23	29	31	2.02	2.65	16	Nil	"	"	"	"

Remarks: -

General File No. 62/399
Well File No.

Petroleum Technology Laboratory, Bureau of Mineral Resources, Geology and Geophysics, Canberra

CORE ANALYSIS RESULTS

NOTE: (i) Unless otherwise stated, porosities and permeabilities were determined on two plugs (V&H) cut vertically and horizontally to the axis of the core. Ruska porosimeter and permeameter were used with air and dry nitrogen as the saturating and flowing media respectively. (ii) Oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates are recorded as Neg., Trace, Fair, Strong or Very Strong.

WELL NAME AND NO. MITCHELL (B.M.R.) SCOUT NO.4 DATE ANALYSIS COMPLETED 21st May, 1968

Core No.	Sample Depth		Lithology	Average Effective Porosity two plugs (% Bulk Vol.)	Absolute Permeability (Millidarcy)		Average Density (gm/cc.)		Fluid Saturation (% pore space)		Core Water Salinity (p.p.m. NaCl)	Acetone Test	Fluorescence of freshly broken core	Stratigraphic unit
	From	To			V	H	Dry Bulk	Apparent Grain	Water	Oil				
1	87'6"	88'0"	Shale & Sandstone	33	N.D.	N.D.	1.78	2.66	35	Nil	N.D.	Trace	Nil	Minmi Member
2	197'0"	197'9"	Sandstone	37	Greater than	4000	1.67	2.65	Nil	"	"	Neg.	"	Hooray Sandstone
3	265'10"	266'1"	"	28	6	N.D.	1.95	2.70	N.D.	N.D.	"	"	"	"
4	306'5"	306'10"	"	31	19	11	1,89	2.75	"	"	"	"	"	"
5	395'4"	395'10"	"	34	784	2110	1.77	2.67	"	"	"	"	"	"
		MITCHELL (B.M.R.) SCOUT NO.5												
1	200'6"	201'0"	Siltstone Claystone	36	N.D.	N.D.	1.70	2.66	"	"	"	"	"	Westbourne Formation
1	204'1"	204'6"	Shale	28	"	"	2.01	2.79	"	"	"	"	"	"

Remarks: -

General File No. 62/399
Well File No. ________

Petroleum Technology Laboratory, Bureau of Mineral Resources, Geology and Geophysics, Canberra

CORE ANALYSIS RESULTS

NOTE: (i) Unless otherwise stated, porosities and permeabilities were determined on two plugs (V&H) cut vertically and horizontally to the axis of the core. Ruska porosimeter and permeameter were used with air and dry nitrogen as the saturating and flowing media respectively. (ii) Oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates are recorded as Neg., Trace, Fair, Strong or Very Strong.

WELL NAME AND NO. MITCHELL (B.M.R.) SCOUT NO.6

DATE ANALYSIS COMPLETED 21st May, 1968

Core No.	Sample Depth		Lithology	Average Effective Porosity two plugs (% Bulk Vol.)	Absolute Permeability (Millidarcy)		Average Density (gm/cc.)		Fluid Saturation (% pore space)		Core Water Salinity (p.p.m. NaCl)	Acetone Test	Fluorescence of freshly broken core	Stratigraphic unit
	From	To			V	H	Dry Bulk	Apparent Grain	Water	Oil				
1	170'6"	171'1"	Sandstone	25	N.D.	N.D.	1.98	2.64	N.D.	N.D.	N.D.	Neg.	Nil	Birkhead Formation
1	174'3"	175'0"	"	26	6	11	1.99	2.73	14	Nil	"	"	"	"

Remarks: -

General File No. 62/399
Well File No.

Petroleum Technology Laboratory, Bureau of Mineral Resources, Geology and Geophysics, Canberra

CORE ANALYSIS RESULTS

NOTE: (i) Unless otherwise stated, porosities and permeabilities were determined on two plugs (V&H) cut vertically and horizontally to the axis of the core. Ruska porosimeter and permeameter were used with air and dry nitrogen as the saturating and flowing media respectively. (ii) Oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates are recorded as Neg., Trace, Fair, Strong or Very Strong.

WELL NAME AND NO. MITCHELL (B.M.R.) SCOUT NO.7

DATE ANALYSIS COMPLETED 21st May, 1968

Core No.	Sample Depth		Lithology	Average Effective Porosity two plugs (% Bulk Vol.)	Absolute Permeability (Millidarcy)		Average Density (gm/cc.)		Fluid Saturation (% pore space)		Core Water Salinity (p.p.m. NaCl)	Acetone Test	Fluorescence of freshly broken core	Stratigraphic unit
	From	To			V	H	Dry Bulk	Apparent Grain	Water	Oil				
1	83'7"	84'0"	Siltstone Sandstone	28	N.D.	N.D.	1.93	2.70	N.D.	N.D.	N.D.	Neg.	Nil	Doncaster Member
2	87'8"	88'4"	Sandstone Siltstone	31	22	"	1.96	2.84	32	Nil	"	"	"	"
3	93'6"	94'0"	Shale	30	N.D.	"	1.96	2.80	N.D.	N.D	"	"	"	"
4	98'8"	99'3"	"	32	"	"	1.93	2.84	"	"	"	"	"	"
5	102'10"	103'7"	Siltstone	32	"	"	1.91	2.81	"	"	"	"	"	"
6	108'6"	109'2"	Shale	32	"	"	1.91	2.81	"	"	"	"	"	"
7	127'1"	127'11"	Siltstone	24	3	20	2.09	2.73	"	"	"	"	"	"
8	140'9"	141'3"	Sandstone	28	155	333	1.99	2.67	"	"	"	"	"	Hooray Sandstone

Remarks: -

General File No. 62/399
Well File No.

Petroleum Technology Laboratory, Bureau of Mineral Resources, Geology and Geophysics, Canberra

CORE ANALYSIS RESULTS

NOTE: (i) Unless otherwise stated, porosities and permeabilities were determined on two plugs (V&H) cut vertically and horizontally to the axis of the core. Ruska porosimeter and permeameter were used with air and dry nitrogen as the saturating and flowing media respectively. (ii) Oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates are recorded as Neg., Trace, Fair, Strong or Very Strong.

WELL NAME AND NO. Mitchell (B.M.R.) Scout No. 7 DATE ANALYSIS COMPLETED 21st May, 1968

Core No.	Sample Depth		Lithology	Average Effective Porosity two plugs (% Bulk Vol.)	Absolute Permeability (Millidarcy)		Average Density (gm/cc.)		Fluid Saturation (% pore space)		Core Water Salinity (p.p.m. NaCl)	Acetone Test	Fluorescence of freshly broken core	Stratigraphic unit
	From	To			V	H	Dry Bulk	Apparent Grain	Water	Oil				
9	156'3"	156'9"	Sandstone	37	620	N.D.	1.71	2.72	N.D.	N.D.	N.D.	Neg.	Nil	Hooray Sandstone
10	180'6"	180'11"	"	32	N.D.	"	1.86	2.71	"	"	"	"	"	"
11	217'0"	217'6"	"	32	126	58	1.82	2.69	"	"	"	"	"	"
12	263'7"	264'0"	"	35	2500	N.D.	1.72	2.65	"	"	"	"	"	"

Remarks: -

General File No. 62/399
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Petroleum Technology Laboratory, Bureau of Mineral Resources, Geology and Geophysics, Canberra

CORE ANALYSIS RESULTS

NOTE: (i) Unless otherwise stated, porosities and permeabilities were determined on two plugs (V&H) cut vertically and horizontally to the axis of the core. Ruska porosimeter and permeameter were used with air and dry nitrogen as the saturating and flowing media respectively. (ii) Oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates are recorded as Neg., Trace, Fair, Strong or Very Strong.

WELL NAME AND NO. Mitchell (B.M.R.) Scout No. 11

DATE ANALYSIS COMPLETED 22nd May, 1968

Core No.	Sample Depth		Lithology	Average Effective Porosity two plugs (% Bulk Vol.)	Absolute Permeability (Millidarcy)		Average Density (gm/cc.)		Fluid Saturation (% pore space)		Core Water Salinity (p.p.m. NaCl)	Acetone Test	Fluorescence of freshly broken core	Stratigraphic unit
	From	To			V	H	Dry Bulk	Apparent Grain	Water	Oil				
1	47'6"	47'10"	Siltstone Shale	32	N.D.	N.D.	1.88	2.77	74	Nil	N.D.	Strong*	Nil	Minmi Member
2	96'8"	94'5"	Sandstone	28	"	"	1.98	2.75	14	Nil	"	Strong*	"	"
3	152'11"	153'6"	"	33	2280	2630	1.78	2.65	N.D.	N.D.	"	Neg.	"	Nullawurt Sandstone Member
4	211'10"	213'6"	Sandstone argillaceous	31	2	6	2.89	2.71	"	"	"	"	"	"
5	273'4"	273'11"	Shale	30	N.D.	N.D.	2.07	2.96	"	"	"	"	"	Kingull Member
6	351'5"	352'0"	"	27	"	"	2.06	2.82	"	"	"	"	"	Mooga Sandstone Member
7	391'8"	392'5"	Sandstone	29	"	814	1.86	2.64	"	"	"	"	"	"

Remarks: - * Attributed to carbonaceous materials in the samples

General File No. 62/399

Well File No. ____________

Petroleum Technology Laboratory, Bureau of Mineral Resources, Geology and Geophysics, Canberra

CORE ANALYSIS RESULTS

NOTE: (i) Unless otherwise stated, porosities and permeabilities were determined on two plugs (V&H) cut vertically and horizontally to the axis of the core. Ruska porosimeter and permeameter were used with air and dry nitrogen as the saturating and flowing media respectively. (ii) Oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates are recorded as Neg., Trace, Fair, Strong or Very Strong.

WELL NAME AND NO. CHINCHILLA (B.M.R.) SCOUT No. 1.

DATE ANALYSIS COMPLETED 1st JULY 1968

Core No.	Sample Depth		Lithology	Average Effective Porosity two plugs (% Bulk Vol.)	Absolute Permeability (Millidarcy)		Average Density (gm/cc.)		Fluid Saturation (% pore space)		Core Water Salinity (p.p.m. NaCl)	Acetone Test	Fluorescence of freshly broken core	STRATIGRAPHIC UNIT
	From	To			V	H	Dry Bulk	Apparent Grain	Water	Oil				
1	65'6"	65'11"	siltstone	46	N.D.	N.D.	1.63	3.01	N.D.	N.D.	N.D.	NEG.	NIL.	Orallo Formation or Injune Creek Group
2	76'5"	76'10"	siltstone	46	N.D.	N.D.	1.47	2.73	N.D.	N.D.	N.D.	NEG.	NIL.	" " " " "
3	83'3"	83'7"	siltstone	46	N.D.	N.D.	1.51	2.80	N.D.	N.D.	N.D.	NEG.	NIL.	" " " " "
4	91'4"	91'8"	siltstone sandstone	43	N.D.	N.D.	1.61	2.82	N.D.	N.D.	N.D.	NEG.	NIL.	" " " " "
5	105'1"	105'6"	"	38	N.D.	N.D.	1.83	2.95	N.D.	N.D.	N.D.	NEG.	NIL.	" " " " "
6	152'10"	153'4"	"	30	N.D.	27	1.96	2.30	N.D.	N.D.	N.D.	NEG.	NIL.	" " " " "

Remarks: -

General File No. 62/399
Well File No. ____________

Petroleum Technology Laboratory, Bureau of Mineral Resources, Geology and Geophysics, Canberra

CORE ANALYSIS RESULTS

NOTE: (i) Unless otherwise stated, porosities and permeabilities were determined on two plugs (V&H) cut vertically and horizontally to the axis of the core. Ruska porosimeter and permeameter were used with air and dry nitrogen as the saturating and flowing media respectively. (ii) Oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates are recorded as Neg., Trace, Fair, Strong or Very Strong.

WELL NAME AND NO. CHINCHILLA (B.M.R.) SCOUT No. 2 DATE ANALYSIS COMPLETED 1st JULY 1968

Core No.	Sample Depth		Lithology	Average Effective Porosity two plugs (% Bulk Vol.)	Absolute Permeability (Millidarcy)		Average Density (gm/cc.)		Fluid Saturation (% pore space)		Core Water Salinity (p.p.m. NaCl)	Acetone Test	Fluorescence of freshly broken core	STRATIGRAPHIC UNIT
	From	To			V	H	Dry Bulk	Apparent Grain	Water	Oil				
1A	19'11"	20'4"	shale	34	N.D.	N.D.	1.95	2.96	N.D.	N.D.	N.D.	NEG.	NIL.	Orallo Formation or Injune Creek Group
1B	25'4"	25'10"	limestone	17	N.D.	N.D.	2.07	2.50	N.D.	N.D.	N.D.	NEG.	NIL.	" " " "
2A	29'3"	29'8½	sandstone	41	N.D.	N.D.	1.63	2.80	N.D.	N.D.	N.D.	NEG.	NIL.	" " " "
2B	32'7"	33'1"	sandstone	39	N:D.	N.D.	1.72	2.82	N.D.	N.D.	N.D.	NEG.	NIL.	" " " "

Remarks: -

General File No. 62/399
Well File No.

Petroleum Technology Laboratory, Bureau of Mineral Resources, Geology and Geophysics, Canberra

CORE ANALYSIS RESULTS

NOTE: (i) Unless otherwise stated, porosities and permeabilities were determined on two plugs (V&H) cut vertically and horizontally to the axis of the core. Ruska porosimeter and permeameter were used with air and dry nitrogen as the saturating and flowing media respectively. (ii) Oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates are recorded as Neg., Trace, Fair, Strong or Very Strong.

WELL NAME AND NO. CHINCHILLA (BMR) SCOUT No. 2A

DATE ANALYSIS COMPLETED 8th JULY 1968

Core No.	Sample Depth		Lithology	Average Effective Porosity two plugs (% Bulk Vol.)	Absolute Permeability (Millidarcy)		Average Density (gm/cc.)		Fluid Saturation (% pore space)		Core Water Salinity (p.p.m. NaCl)	Acetone Test	Fluorescence of freshly broken core	STRATIGRAPHIC UNIT
	From	To			V	H	Dry Bulk	Apparent Grain	Water	Oil				
1	32'4"	32'8"	siltstone sandstone	39	N.D.	N.D.	1.69	2.77	N.D.	N.D.	N.D.	Neg.	NIL	Orallo Formation or Injune Creek Group
2	45'	45'6"	claystone	N.D.	N.D.	N.D.	1.59	N.D.	N.D.	N.D.	N.D.	Neg.	NIL	" "
3	52'4"	52'8"	"	N.D.	N.D.	N.D.	1.54	N.D.	N.D.	N.D.	N.D.	Neg.	NIL	" "
4	116'	116'6"	sandstone	39	107	N.D.	1.84	3.02	N.D.	N.D.	N.D.	Neg.	NIL	" "
5	120'	120'7"	"	36	73	76	1.88	2.94	N.D.	N.D.	N.D.	Neg.	NIL	" "
6	129'3"	129'9"	"	32	495	N.D.	1.86	2.74	N.D.	N.D.	N.D.	Neg.	NIL	" "
7	143'	143'6"	"	30	N.D.	34	1.94	2.78	N.D.	N.D.	N.D.	Neg.	NIL	" "
8	155'9"	156'2"	"	29	30	48	1.94	2.73	N.D.	N.D.	N.D.	Neg.	NIL	" "

Remarks: -

General File No. 62/399
Well File No.

Petroleum Technology Laboratory, Bureau of Mineral Resources, Geology and Geophysics, Canberra

CORE ANALYSIS RESULTS

NOTE: (i) Unless otherwise stated, porosities and permeabilities were determined on two plugs (V&H) cut vertically and horizontally to the axis of the core. Ruska porosimeter and permeameter were used with air and dry nitrogen as the saturating and flowing media respectively. (ii) Oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates are recorded as Neg., Trace, Fair, Strong or Very Strong.

WELL NAME AND NO. CHINCHILLA (B.M.R.) SCOUT No. 3 DATE ANALYSIS COMPLETED 23rd May, 1968

Core No.	Sample Depth		Lithology	Average Effective Porosity two plugs (% Bulk Vol.)	Absolute Permeability (Millidarcy)		Average Density (gm/cc.)		Fluid Saturation (% pore space)		Core Water Salinity (p.p.m. NaCl)	Acetone Test	Fluorescence of freshly broken core	STRATIGRAPHIC UNIT
	From	To			V	H	Dry Bulk	Apparent Grain	Water	Oil				
1	55'1"	55'6"	Shale * Sideritic	8	N.D.	N.D.	3.12	3.40	N.D.	N.D.	N.D.	Neg.	NIL	Injune Creek Group
2	114'1"	114'5"	Sandstone	20	"	26	2.20	2.75	N.D.	N.D.	N.D.	Neg.	NIL	"
3	176'0"	176'6"	"	22	48	34	2.12	2.71	N.D.	N.D.	N.D.	Neg.	NIL	"
4	260'10"	261'4"	"	25	23	27	2.05	2.71	N.D.	N.D.	N.D.	Neg.	NIL	Hutton Sandstone

Remarks: - * Confirmed by petrological examination

General File No. 62/399
Well File No.

Petroleum Technology Laboratory, Bureau of Mineral Resources, Geology and Geophysics, Canberra

CORE ANALYSIS RESULTS

NOTE: (i) Unless otherwise stated, porosities and permeabilities were determined on two plugs (V&H) cut vertically and horizontally to the axis of the core. Ruska porosimeter and permeameter were used with air and dry nitrogen as the saturating and flowing media respectively. (ii) Oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates are recorded as Neg., Trace, Fair, Strong or Very Strong.

WELL NAME AND NO. CHINCHILLA (B.M.R.) SCOUT No. 4

DATE ANALYSIS COMPLETED 28th MAY 1968

Core No.	Sample Depth		Lithology	Average Effective Porosity two plugs (% Bulk Vol.)	Absolute Permeability (Millidarcy)		Average Density (gm/cc.)		Fluid Saturation (% pore space)		Core Water Salinity (p.p.m. NaCl)	Acetone Test	Fluorescence of freshly broken core	STRATIGRAPHIC UNIT
	From	To			V	H	Dry Bulk	Apparent Grain	Water	Oil				
1	53'7"	54'2"	Sandstone, iron-stained	32	N.D.	NIL	1.93	2.84	N.D.	N.D.	N.D.	Neg.	NIL	Hutton Sandstone
2	107'5"	107'10"	Shale	Drying	cracks		occurred		results	unreliable			NIL	Upper Evergreen Formation
3	172'3"	172'8"	Shale sideritic	14	NIL	NIL	3.09	3.59	N.D.	N.D.	N.D.	Neg.	NIL	"
4	217'10"	218'2"	"	9	NIL	NIL	2.96	3.31	N.D.	N.D.	N.D.	Neg.	NIL	Oölitic ironstone member
5	305'6"	305'11"	Sandstone	19	2	3	2.16	2.66	N.D.	N.D.	N.D.	Neg.	NIL	Lower Evergreen Formation

Remarks: -

General File No. 62/399
Well File No.

Petroleum Technology Laboratory, Bureau of Mineral Resources, Geology and Geophysics, Canberra

CORE ANALYSIS RESULTS

NOTE: (i) Unless otherwise stated, porosities and permeabilities were determined on two plugs (V&H) cut vertically and horizontally to the axis of the core. Ruska porosimeter and permeameter were used with air and dry nitrogen as the saturating and flowing media respectively. (ii) Oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates are recorded as Neg., Trace, Fair, Strong or Very Strong.

WELL NAME AND NO. CHINCHILLA (B.M.R.) SCOUT NO. 5 DATE ANALYSIS COMPLETED 28th MAY 1968

Core No.	Sample Depth		Lithology	Average Effective Porosity two plugs (% Bulk Vol.)	Absolute Permeability (Millidarcy)		Average Density (gm/cc.)		Fluid Saturation (% pore space)		Core Water Salinity (p.p.m. NaCl)	Acetone Test	Fluorescence of freshly broken core	STRATIGRAPHIC UNIT
	From	To			V	H	Dry Bulk	Apparent Grain	Water	Oil				
1	91'7"	92'0"	Sandstone sideritic bands	30	N.D.	1	1.98	2.83	N.D.	N.D.	N.D.	Neg.	NIL	Evergreen Formation
2	172'10"	173'3"	"	24	N.D.	2	2.10	2.76	N.D.	N.D.	N.D.	Neg.	NIL	Evergreen Formation
3	279'4"	279'8"	Shale	19	N.D.	N.D.	2.25	2.77	N.D.	N.D.	N.D.	Neg.	NIL	Evergreen Formation
4	345'9"	346'4"	Sandstone	22	NIL	4	2.11	2.70	N.D.	N.D.	N.D.	Neg.	NIL	Evergreen Formation
CHINCHILLA (BMR) SCOUT NO. 6														
1	66'9"	67'0"	Sandstone	31	N.D.	N.D.	1.84	2.67	N.D.	N.D.	N.D.	Neg.	NIL	Hutton Sandstone
2	201'1"	202'3"	Sandstone	29	108	N.D.	2.03	2.86	N.D.	N.D.	N.D.	Neg.	NIL	Evergreen Formation
3	307'2"	307'8"	Sandstone	29	N.D.	463	1.89	2.67	N.D.	N.D.	N.D.	Neg.	NIL	Evergreen Formation

Remarks: -

General File No. 62/399
Well File No.

Petroleum Technolog; Laboratory, Bureau of Mineral Resources, Geology and Geophysics, Canberra

CORE ANALYSIS RESULTS

NOTE: (i) Unless otherwise stated, porosities and permeabilities were determined on two plugs (V&H) cut vertically and horizontally to the axis of the core. Ruska porosimeter and permeameter were used with air and dry nitrogen as the saturating and flowing media respectively. (ii) Oil and water saturations were determined using Soxhlet type apparatus. (iii) Acetone test precipitates are recorded as Neg., Trace, Fair, Strong or Very Strong.

WELL NAME AND NO. CHINCHILLA (B.M.R.) Scout No. 7.

DATE ANALYSIS COMPLETED 5th June, 1968.

Core No.	Sample Depth		Lithology	Average Effective Porosity two plugs (% Bulk Vol.)	Absolute Permeability (Millidarcy)		Average Density (gm/cc.)		Fluid Saturation (% pore space)		Core Water Salinity (p.p.m. NaCl)	Acetone Test	Fluorescence of freshly broken core	STRATIGRAPHIC UNIT
	From	To			V	H	Dry Bulk	Apparent Grain	Water	Oil				
1	107'3"	107'11"	Siltstone	29	N.D.	N.D.	1.99	2.80	N.D.	N.D.	N.D.	Neg.	NIL	Evergreen Formation or Hutton Sandstone
2	196'0"	196'6"	Sandstone	28	116	291	1.92	2.66	N.D.	N.D.	N.D.	Neg.	NIL	Evergreen Formation or Hutton Sandstone
3	272'4"	272'11"	Sandstone	27	36	36	1.94	2.65	N.D.	N.D.	N.D.	Neg.	NIL	Evergreen Formation or Hutton Sandstone
	CHINCHILLA (B.M.R.) SCOUT No. 8.													
1	77'8"	78'1"	Sandstone	22	Nil	Nil	2.19	2.79	N.D.	N.D.	N.D.	Neg.	NIL	Orallo Formation
2	214'4"	214'11"	"	18	"	4	2.22	2.69	N.D.	N.D.	N.D.	Neg.	NIL	Orallo Formation
3	262'11"	263'4"	Sandstone Sideritic	17	Nil	Nil	2.33	2.81						Orallo Formation

Remarks: -

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APPENDIX 5

CHEMICAL ANALYSIS OF SAMPLES FROM THE SURAT BASIN, QUEENSLAND

by

D.W. Bennett

The following results were obtained for the analysis of six samples from the Surat Basin, Queensland, submitted by N.F. Exon and party.

Reg. No.	67580872	67580873
ppm Cu	40	6900

Reg. No.	67580309	67580382	67580385	67580951
SiO_2	71.4%	65.4%	36.4%	
Fe_2O_3	8.4%	6.6%	34.3%	19.3%
Al_2O_3	11.2%	17.2%	19.3%	
Loss at 1000°C	6.4%	7.7%	9.4%	

Copper was determined by the Atomic Absorption method following digestion with hydrochloric acid. Silica and (Fe_2O_3 + Al_2O_3) were determined gravimetrically following fusion of the sample with sodium carbonate. The iron determinations were by Atomic Absorption after sodium carbonate fusions.

Laboratory Report No. 8.

Serial Nos. 2631, 2840

Note:

The copper analyses are of samples from Carboniferous volcanics on Chinchilla Sheet. Sample 67580872 is from GR418763; sample 67580873 is from GR416764.

The silica, iron oxide, alumina and water analyses are from deeply weathered crusts on older rocks. Sample 67580309 is from an old soil development on Hutton Sandstone (GR320753). Sample 67580382 is from deeply weathered Cz silt, and sand (GR378750). Sample 67580385 is from the Surat Sheet area (Thomas and Reiser, 1968). Sample 67580951 is from a ferruginous soil underlying Tertiary basalt (GR453660).

REFERENCE: Thomas, B.M., and Reiser, R.F., 1968: The geology of the Surat 1:250,000 Sheet area, Queensland. Bur. Miner. Resour. Aust. Rec. 1968/56.

APPENDIX 6

CARBONIFEROUS RUGOSE CORALS FROM THE CHINCHILLA SHEET

by

D.L. Strusz

INTRODUCTION

This report deals with a collection of rugose corals from a single locality on the Chinchilla 1:250,000 Sheet. The specimens are all poorly preserved and partially silicified; in some cases the internal structures have been partly obliterated. The corals occur in a fairly well sorted coarse calcarenite consisting of intraclasts, coated grains (often crinoid fragments) and skeletal debris, in a matrix of sparry calcite. Recrystallization has affected this matrix to a variable extent, but it does seem that at least in part the sparite is original. The grains are flattened, partly because of original shape or compaction, and partly by later tectonic compression. Several of the corals (which are somewhat worn) have been deformed to a slightly oval cross section, but others are circular; it is possible that in some cases they were originally oval.

Locality: 6 miles west-north-west of Monogorilby school, on the western side of a north-north-west trending ridge overlooking a sharp bend in a gully and immediately north-east of a track connecting the Hawkwood road with homesteads to the east; Chinchilla Sheet, grid reference 393.767; photo 5026, run 1, point SB/333. A limestone lens in tuffs and fine tuffaceous sediments.

IDENTIFICATIONS

Amplexocarinia simplex (HILL, 1934).

Aulina simplex HILL, 1934, p. 93, pl. 11, figs. 12-29, text-fix.4.

Diagnosis: Irregularly cylindrical, about 5 mm, in diameter; about 2x20 septa, the minor very short, the major ending in an aulos about 1/3 the corallite diameter. Tabulae flat and distant in aulos, steeply inclined and closer outside it. Dissepiments rare, may be lonsdaleoid.

Distribution: Type locality -- Riverleigh Limestone, near Mundubbera, Qld. (HILL, 1934).

Present Material: F23008, 23009/2,?23009/3. The first is 6mm in diameter, with about 15 major septa, and an aulos a little under 1/3 the corallite diameter; it differs from the Riverleigh form in having fewer septa. The second corallite has 2x22 septa at 3.5 mm diameter, about 2x24 septa at 4 mm diameter, and is thus closer to the Riverleigh form; the axial part of the corallite has been obliterated by recrystallization. F23009/3 is very poorly preserved, about 3.5 mm across; it probably belongs to this species.

HILL gave no details of variation in diameter and septal number; however the general structural agreement with her description is such as to make specific identity very probable.

Lithostrotion stanvellense ETHERIDGE fil., 1900

Lithostrotion(?) stanvellensis ETHERIDGE fil., 1900, p. 20, pl. 1, fig. 5, pl. 2, fig. 7-8.

Lithostrotion stanvellense; HILL, 1934, p. 85, pl.10 fig. 26-33, text-fig. 3; HILL & WOODS, 1964, pl. Cl fig. 5.

Diagnosis: Dendroid species up to 22 mm but usually 8-10 mm in diameter, with 24-44 straight thin major septa which generally join the prominent columella; minor septa about 1/3 major in length. 2-3 series of small dissepiments, rarely lonsdaleoid; tabularium wide, of vesicular tabellae.

Distribution: HILL (1934) reported the species from the Upper Viséan Lion Creek Limestone at Stanwell (type locality), the Riverleigh Limestone, and Diglum, Qld., and from the Viséan Burindi limestones near Bingara, N.S.W. HILL & DENMEAD (1960, p. 166) have recorded the species from near Pikedale, southern Qld., and HILL & WOODS (1964) figured a specimen from the Viséan Baywulla Formation near Monto, Qld.

Present Material: F23006, ?23010. The former closely resembles the smaller forms described by HILL (1934); the largest corallite is 8.6 mm across, with 2x34 septa (some interrupted by lonsdaleoid dissepiments); another has 2x22 septa at a diameter of 4.7 mm F23010 is a fragment 9.3 mm across which probably belongs to this species, but is too poorly preserved for positive identification.

Amygdalophyllum conicum HILL, 1934

Amygdalophyllum conicum HILL, 1934, p. 70, pl. 8, fig. 14-48, text-fig. 7.

Diagnosis: Conical, up to 2 cm in diameter, with deep conical calice, small columella, and about 2x30 septa. Straight, usually slightly dilated major septa generally meet the columella; in adults increased septal dilatation may form a stereozone in the tabularium or, more often, peripherally. The septa may become naotic in the peripheral stereozone, or may withdraw from the wall.

Distribution: Type locality - Riverleigh Limestone (HILL, 1934).

Amygdalophyllum sp. cf. conicum HILL, 1934

Material: F 23002 to 23005, 23007, 23009/1, ?23011. Of the described Australian species, these most resemble A. conicum. The corallites are irregularly conical to ceratoid, some 15-20 mm in diameter with 2x(36-40) septa. In those whose axial tissues are still visible, the major septa approach or join a small columella; they are moderately fusiform. The minor septa, thinner than the major, are about 1/3 as long. There is a suggestion of lonsdaleoid dissepiments in F23007.

Closest to the holotype and other specimens of smallish size and little modified septa (HILL, 1934, e.g. pl. 8 fig. 15-19, 27-29), these specimens differ from A. conicum mainly in their more numerous septa and noticeably fusiform dilatation.

CONCLUSIONS

All authors who have mentioned the Riverleigh fauna, which includes these three species, have agreed on its Late Viséan age. (see e.g. HILL, 1934, 1948; HILL & DENMEAD, 1960; JULL, 1965). While the fauna from SB/333 is limited and poorly preserved, it is sufficient to permit fairly close correlation with the Riverleigh and Lion Creek faunas, and can therefore be assigned a Viséan, probably Late Viséan, age. The Riverleigh Limestone some 30 miles to the

NNE is virtually on strike with this locality, and the two sequences could be closely comparable.

The fossiliferous material from SB/333 is stored in the Museum of the Bureau of Mineral Resources under the numbers F23001 to 23012.

REFERENCES

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Department of National Development

BUREAU OF MINERAL RESOURCES, GEOLOGY & GEOPHYSICS

PLATES TO ACCOMPANY

RECORD No. 1968 / 153

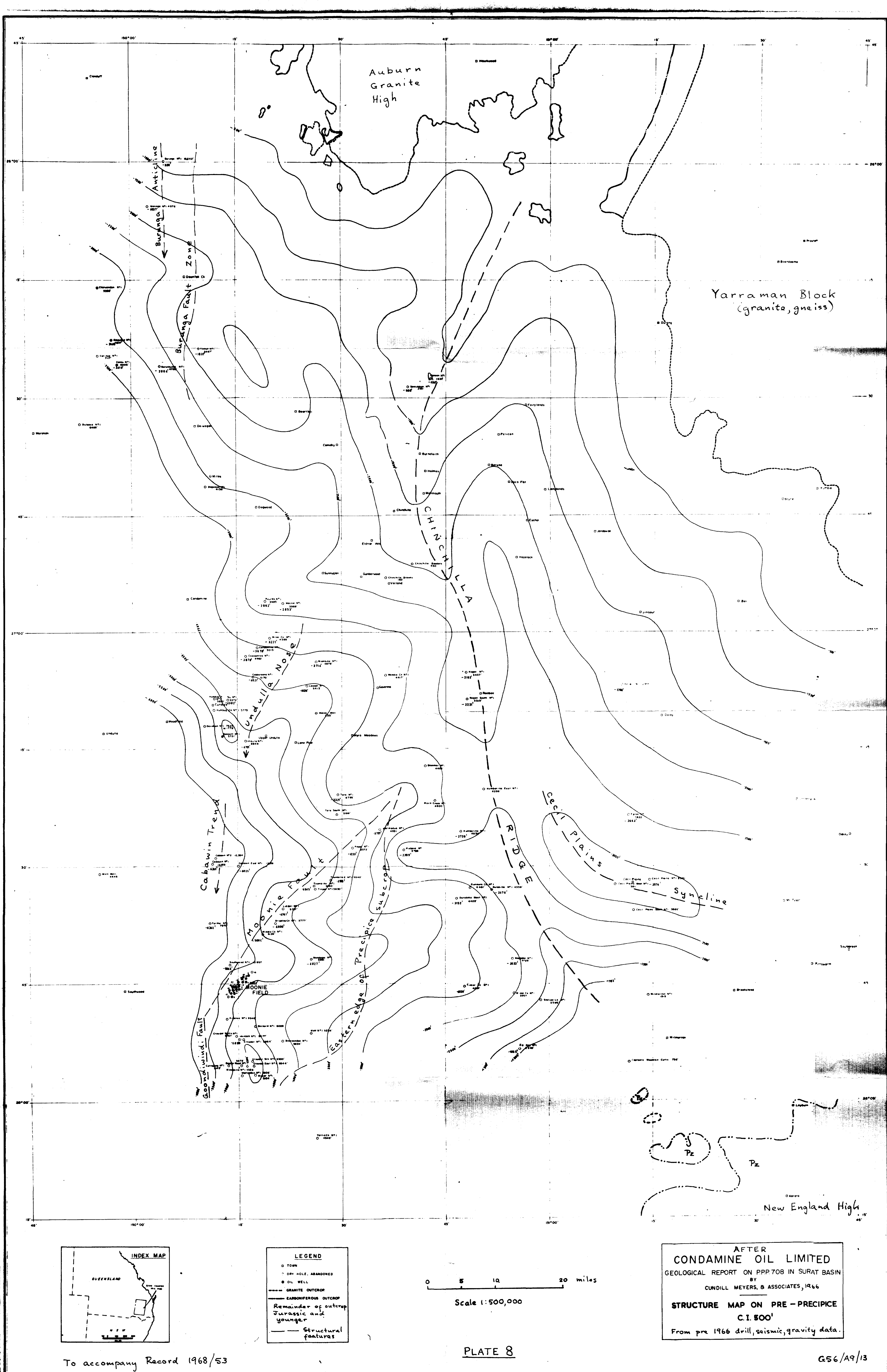

Auburn Granite High
Yarraman Block (granite, gneiss)
Burunga Anticline
Burunga Fault Zone
CHINCHILLA RIDGE
Undulla Nose
Cabawin Trend
Moonie Fault
Eastern edge of Precipice subcrop
Cecil Plains Syncline
Goondiwindi Fault
MOONIE FIELD
Pz
New England High
INDEX MAP
QUEENSLAND
LEGEND
TOWN
DRY HOLE, ABANDONED
OIL WELL
GRANITE OUTCROP
CARBONIFEROUS OUTCROP
Remainder of outcrop Jurassic and younger
Structural features
0 5 10 20 miles
Scale 1:500,000
AFTER
CONDAMINE OIL LIMITED
GEOLOGICAL REPORT ON PPP 708 IN SURAT BASIN
BY
CUNDILL MEYERS, & ASSOCIATES, 1966
STRUCTURE MAP ON PRE-PRECIPICE
C.I. 500'
From pre 1966 drill, seismic, gravity data.
To accompany Record 1968/53
PLATE 8
G56/A9/13

PLATE 9

0 1 2 3 4 5
miles

To accompany Record 1968/53

G56/A9/14

SUMMARY OF DATA OBTAINED BY PHILLIPS CHARLEY'S CREEK DRILLING (OLSON, 1963)

(Superimposed on BMR geological map)

(* De Jersey and Paten, 1963).

× CKA(A1) Locality of shallow drill hole Phillips-Sunray Charley's Ck Scout No. 1. (A1) is company's reference number. "Boxed" holes have palynological evidence* of Evergreen-Je-age. Other, bracketed, data is lithological and generally refers to basement.

CORRELATION OF OIL WELLS

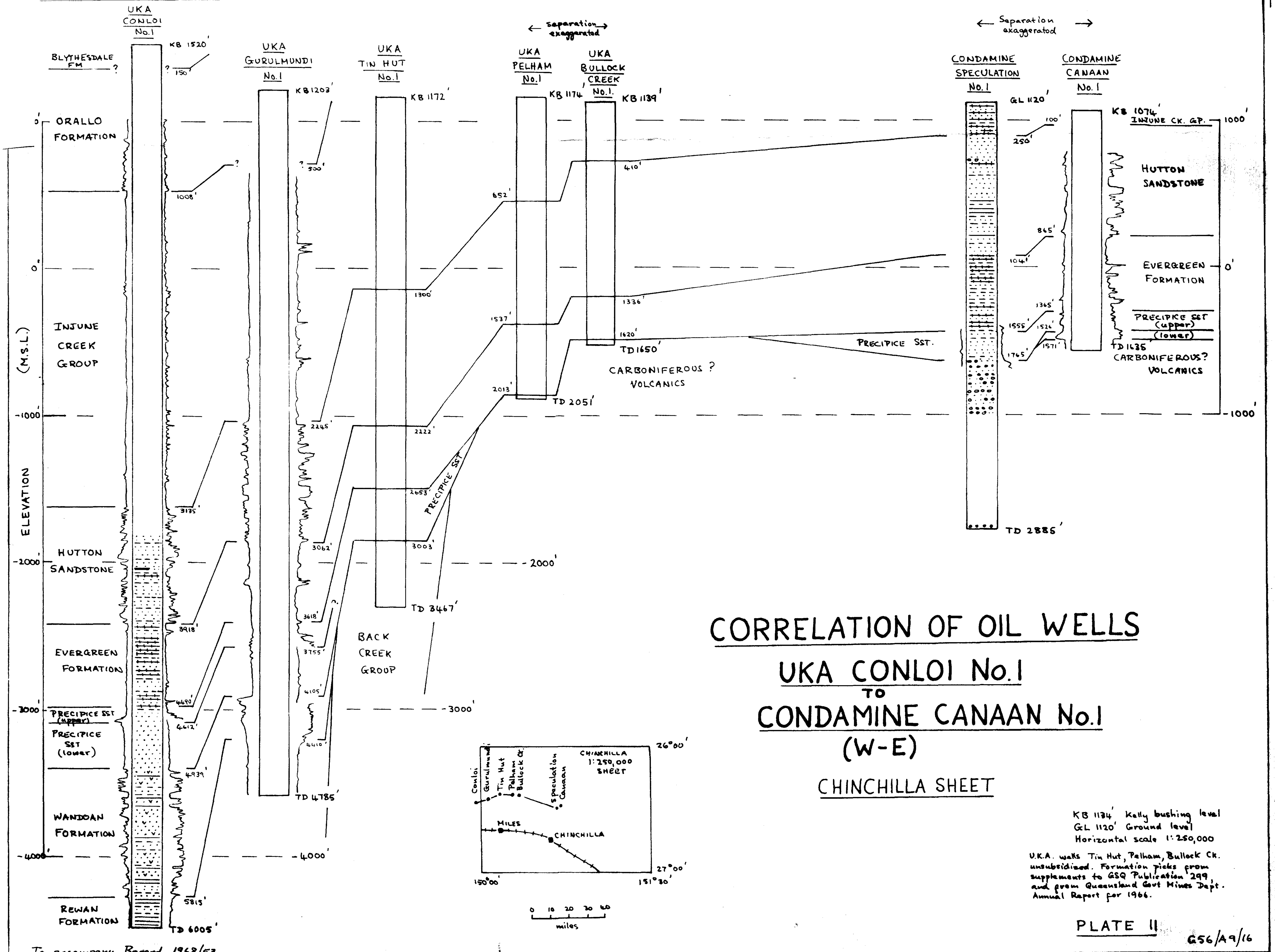
U.K.A. BURUNGA No.1 TO PHILLIPS-SUNRAY YARRALA No.1 (NW - SE)

CHINCHILLA & DALBY SHEETS

PLATE 10

To accompany Record 1968/53

G56/A9/15



CORRELATION OF OIL WELLS

UKA CONLOI No.1 TO CONDAMINE CANAAN No.1 (W-E)

CHINCHILLA SHEET

KB 1134' Kelly bushing level
GL 1120' Ground level
Horizontal scale 1:250,000

U.K.A. wells Tin Hut, Pelham, Bullock Ck. unsubsidized. Formation picks from supplements to GSQ Publication 299, and from Queensland Govt Mines Dept. Annual Report for 1966.

PLATE II

G56/A9/16

To accompany Record 1968/53

AUSTRALIA 1:250,000 GEOLOGICAL SERIES

CHINCHILLA
QUEENSLAND

SHEET SG 56-9

Reference

CAINOZOIC	QUATERNARY		Qa	Alluvium	
			Qs	Sand, some sandy soil	
			Cz	Very poorly sorted sandstone, conglomeratic sandstone, breccia and siltstone	
			Czc	Clayey residual soil, some sandy	
			Czg	Granite wash	
			Czw	Deep weathering profile and younger ferruginous material	
TERTIARY	PLIOCENE	Chinchilla Sand	Tc	Labile sandstone, conglomerate, siltstone, mudstone; vertebrate fossils	
			T	Well to poorly sorted sandstone, some pebbly siltstone	
			Tb	Olivine basalt, tuff, agglomerate	
MESOZOIC	LOWER CRETACEOUS	Undifferentiated	K	Clayey sandstone, siltstone, mudstone	
		Wallumbilla Formation	Klu	Siltstone, mudstone; minor sandstone	
		Coreena Member	Klc	Siltstone, mudstone, fine sandstone, glauconitic in part	
		Doncaster Member	Kld	Mudstone, siltstone, glauconitic in part	
		Blythesdale Formation	Klb	Clayey, fine quartzose to sublabile sandstone; siltstone	
	MIDDLE TO UPPER JURASSIC	Orallo Formation	Juo	Clayey labile sandstone, siltstone, mudstone, claystone; minor bentonite, polymictic conglomerate	
		Injune Creek Group	Ji	Calcareous labile sandstone, siltstone, mudstone, coal	
	LOWER JURASSIC	Hutton Sandstone	Jlh	Quartzose sandstone, some clayey, some pebbly; siltstone	
		Evergreen Formation	Jle	Basinal facies: Mudstone, siltstone, minor sandstone. Section only	
			Jle$_e$	Eastern marginal facies: Feldspathic sublabile sandstone, some pebbly; siltstone, mudstone, minor pelletal ironstone	
			Jle$_2$	Feldspathic to sublabile sandstone, siltstone	Western marginal facies
			Jlo	Concretionary ironstone, oolitic in part; fine lithic sandstone, siltstone, mudstone	Western marginal facies
			Jle$_1$	Feldspathic to sublabile sandstone, some pebbly, some calcareous; siltstone, mudstone	Western marginal facies
		Precipice Sandstone	Jlp	Quartzose sandstone and siltstone	Section only
	TRIASSIC	Wandoan Formation	Rw	Grey to grey-green clayey sublabile sandstone, conglomerate, shale and siltstone	Section only
	LOWER TRIASSIC	Rewan Formation	Rlr	Multicoloured volcanic and lithic sandstones, some clayey; conglomerate, siltstone and shale	Section only
	TRIASSIC OR PERMIAN		Mg	Granite; acid to basic dykes	
			Mm	Schist, gneiss; acid to basic dykes	
PALAEOZOIC	PERMIAN	Back Creek Group	Pb	Tuffaceous shale, siltstone, sandstone and conglomerate	Section only
	PERMIAN OR CARBONIFEROUS		P-C	Andesitic and dacitic flows; lesser pyroclastics	Section only
	LOWER CARBONIFEROUS		C	Tuff; tuffaceous sandstone, siltstone and shale; conglomerate; lesser rhyolite, basalt, recrystallized limestone. Marine macrofossils	

Geological boundary, position approximate; where inferred, queried
Syncline, position approximate
Fault, position accurate
Fault, position approximate; where inferred, queried
Fault, concealed (D, U indicate relative movement down, up)
Lineament, air-photo interpretation

Strike and dip of strata
Dip < 5° (air photo interpretation)
Trend lines (air photo interpretation)
Joint pattern (air photo interpretation)
Strike and dip of foliation in metamorphics

SB333 Macrofossil locality, with reference number
Plant fossil locality
Fossil wood locality
Vertebrate fossil locality, Pliocene Chinchilla Sand
P Vertebrate fossil locality, Pleistocene
Dyke, rhyolite

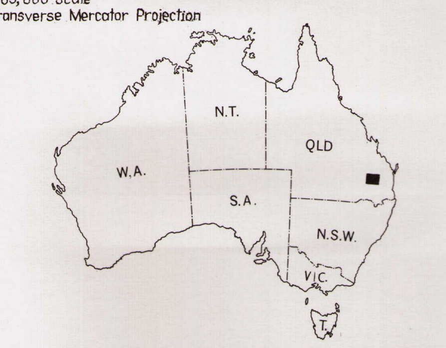
Dry hole, abandoned
Abandoned well with show of oil
Abandoned well with show of gas
St Stratigraphic hole, BMR Chinchilla

(Sn) Unworked deposit, tin, alluvial
(Cb) Unworked deposit, bentonite
Cu Mine - minor, copper
.Cu Mineral occurrence, copper
Quarry: Cl - clay, Rc - crushed basalt aggregate

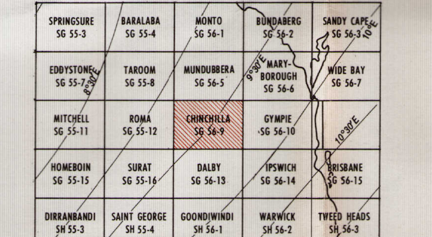
Abandoned bore
16181 Artesian bore, flowing; with IWS registered number
Artesian bore, ceased to flow
Sub-artesian bore
(Solid rings indicate field checked; broken rings from IWS data)
E Earth tank
Dam on stream
WH Waterhole
Spring

Highway
Road
Vehicle track
Railway with station and siding
Airport
Landing ground
"Everton" Homestead
Building
Yd Yard
Town
Trigonometrical station
•1039' Height in feet, instrument levelled
•1058' Height in feet, barometric
(Datum: mean sea level)
(PA) Position approximate
7/5148 Air photo centre, run and number

Compiled by the Bureau of Mineral Resources, Geology and Geophysics, Department of National Development, in conjunction with the Geological Survey of Queensland. Issued under the authority of the Hon. David Fairbairn, Minister for National Development. Base map compiled by the BMR from material supplied by the Royal Australian Survey Corps. Commonwealth aerial photography; complete vertical coverage at 1:85,000 scale
Transverse Mercator Projection



INDEX TO ADJOINING SHEETS
Showing Magnetic Declination

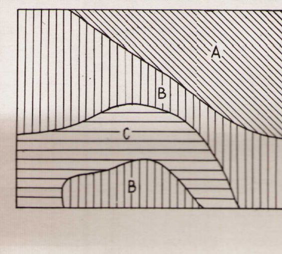


ANNUAL CHANGE 2'E

Scale 1:250,000

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

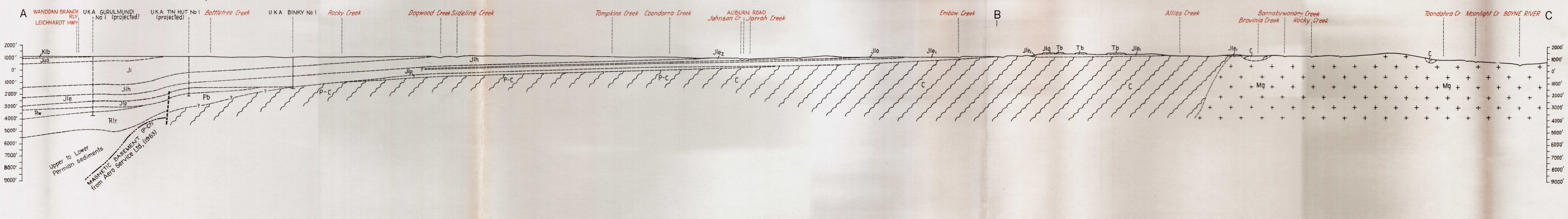
GEOLOGICAL RELIABILITY DIAGRAM



A Semi-detailed mapping and detailed reconnaissance
B Detailed reconnaissance
C General reconnaissance

Geology and compilation, 1967, by: N.F. Exon, D. Burger, A.R. Jensen, B.M. Thomas, (BMR), and R.F. Reiser, (GSQ)
Cartography by: Geological Branch BMR
Drawn by: D.M. Pillinger

Section
(Cainozoic sediments omitted from section)
Scale: $\frac{V}{H} = 4$



CHINCHILLA

SHEET SG 56-9

Complimentary

PLATE 13

REFERENCE FOR DRILL HOLE LOGS

sandstone

		grain size (mm)
v.f.	very fine	0·06 - 0·12
f	fine	0·12 - 0·25
m	medium	0·25 - 1·0
c	coarse	1·0 - 2·0

quartzose sandstone > 90% clasts quartz
sublabile (feldspathic, lithic) 75-90% " "
labile (feldspathic, lithic) < 75% " "

conglomerate

siltstone

shale

mudstone

claystone

limestone

coal band

Tuff and tuffaceous sediment

bedding structure

very thick	> 40"
thick	12 - 40"
medium	4 - 12"
thin	0·4 - 4"
laminate	< 0·4"

brackets around symbol indicate poor development

cross bedded
slumped
ripple marks
trails

other symbols

calcareous concretion
plant fossil
J 3 contains spores of Evans' division J 3

abbreviations

si	siliceous
fe	ferruginous
mic	micaceous
calc	calcareous
feld	feldspathic
carb	carbonaceous
sst	sandstone
siltst	siltstone
mudst	mudstone
clayst	claystone
grnd	grained
r.f.	rock fragments
conc	concretionary

Core : Recovery 75%

To accompany Record 1968/53

G56 /A/12