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EROMANGA BASIN

GEOLOGICAL STUDIES

REPORTS

Submitted by

Delhi Petroleum Pty Ltd and Santos Ltd
1988

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TENEMENT: Not applicable

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Swindon, V.G. and Moore, P.S., 1984. Exploration and production, Eromanga Basin, Central Australia (August 1984). — **8621 R 1** Pgs 3-47

Gausden, J., 1979. Landsat interpretation [of the] western Great Artesian Basin (consultant's report for Delhi Petroleum Pty Ltd, June 1979). — **8621 R 2** Pgs 48-60

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CRETACEOUS STRATIGRAPHY OF THE SOUTHWESTERN EROMANGA BASIN - PART I:

GENERAL INTRODUCTION, FORMATION TOPS AND LOG CORRELATION DIAGRAMS FOR THE INTERVAL: TOOLEBUC FORMATION TO 'C' HORIZON

Received 3 Sept. 1982

Peter S. Moore
Regional Geologist
Delhi Petroleum Pty. Ltd.

June, 1982

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PART A

GENERAL INTRODUCTION

1. INTRODUCTION

This study was initiated early in 1981 as attention became increasingly focussed on the Eromanga Basin sequence. In particular, the study was designed to provide data on the following:

a) thickness and correlation of Aptian-Albian units throughout the basin

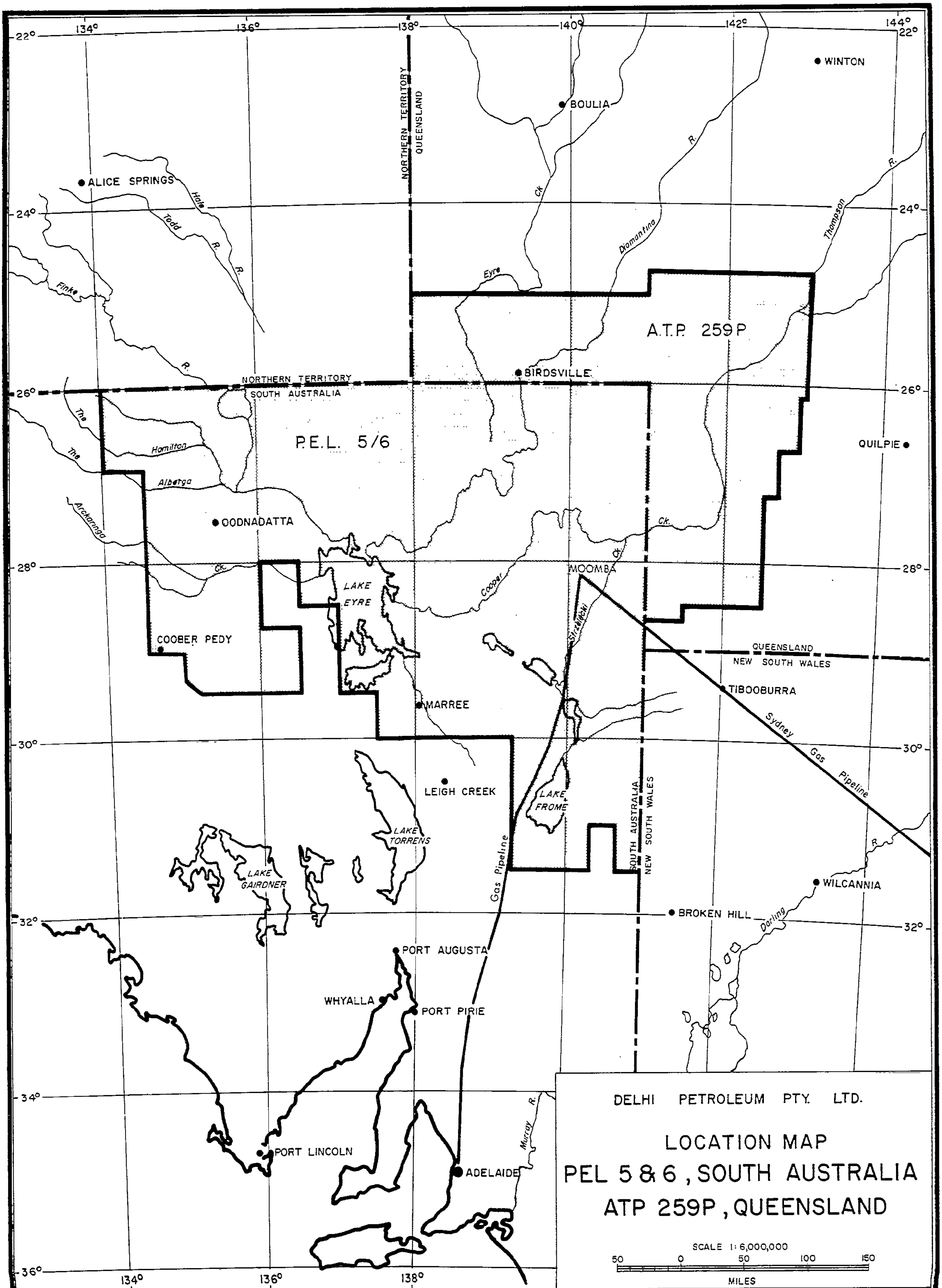
b) timing of structural movements

c) the nature and distribution of the Toolebuc Formation

d) the relationship between Aptian-Albian glauconitic sandstones in the southern Cooper Basin area and the Toolebuc Formation gamma-ray anomaly elsewhere

e) the hydrocarbon potential of the section above 'C'.

The location of the study area is shown in Figure 1. The study was stimulated by minor gas shows in organic shales of the Toolebuc Formation in Queensland, and oil shows in glauconitic sandstones at a similar level in South Australia. In Strzelecki No. 4, a 48' thick glauconitic sandstone at 3270'-3318' was subjected to an open-hole drill stem test, and produced gas to surface at a rate too small to measure (RTSTM), thus confirming that hydrocarbons have been generated in the sequence. In May, 1982, Strzelecki No. 8 tested the same sandstone interval nearby, and produced gas to surface at the rate of 350,000 cu. ft./day.



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Dwg. No. 82XG-1337 File 0-42

FIGURE 1

2. PREVIOUS STRATIGRAPHIC FRAMEWORK

The informal stratigraphic nomenclature used by oil companies in P.E.L. 5 and 6 and ATP 259P for the interval 'Surface to 'C' horizon' is shown in Figure 2. The names "Winton Formation", "Tambo Formation", "Toolebuc Formation" and "Roma Formation" had diverse origins, but over the years had come to be used in a context not originally intended. For example, the Tambo and Roma "Formations" were originally defined as chronostratigraphic terms (Tambo and Roma Series) with age and faunal (rather than lithological) implications.

The problem of Cretaceous subsurface stratigraphy was highlighted in 1981 however, when mapping of the Toolebuc Formation was initiated. At this stage, it was believed that the Toolebuc Formation was an organic-rich marine shale throughout most of the Delhi-Santos licence area, but that it underwent a facies change in the Southern Cooper Basin region, where it passed laterally into a glauconitic greensand. Thus, both the organic-rich shale and the greensand were referred to as the "Toolebuc Formation", and only one set of stratigraphic names was necessary to describe the sequence in the subsurface.

By mid-1981, detailed stratigraphic mapping using gamma-ray, sonic and other electric logs had established this correlation to be incorrect, with the Toolebuc gamma-ray anomaly occurring approximately 200-300 feet higher in the sequence than the greensand. The reason for the miscorrelation was then obvious; the Toolebuc gamma-ray anomaly and the greensand were essentially mutually exclusive. Where one unit was present, the other was absent. The consequences of the discovery, however, were great because it was obvious that new names had to be established for the greensand and vertically adjacent units.

Further stratigraphic problems arose from the study. In some areas, both the Toolebuc gamma-ray anomaly and the greensand were absent. Alternatively it was discovered that in a few examples both the Toolebuc anomaly and the greensand were developed in the one area. Any stratigraphic system to be implemented had to cope with these variations.

3. NEW STRATIGRAPHIC FRAMEWORK

3.1 INTRODUCTION

In arriving at a new stratigraphic framework for the Aptian-Albian sequence of the south western Eromanga Basin, (Figure 2) several objectives were set:

(a) new stratigraphic names should be avoided where-ever possible;

(b) recent work of the Bureau of Mineral Resources (Senior et al., 1978) should be used and extended into the relevant portions of South Australia;

(c) a link between South Australian outcrop geology and the subsurface should be established if possible;

(d) the system established should be acceptable to both Delhi Petroleum Pty. Ltd. and associates, and the South Australian Department of Mines and Energy;

(e) in doing so, the stratigraphy should be acceptable to the Stratigraphic Nomenclature Committee and thus recognised journals;

(f) the system should be useful to Delhi Petroleum Pty. Ltd. and associates in their quest for further oil and gas discoveries.

The author believes that all of these objectives have been achieved. No new stratigraphic names have been introduced, although one unit of member status has been elevated to a formation. The new stratigraphic nomenclature is summarised in Figure 2.

The new nomenclature is basically a dual system, which utilises different stratigraphic names depending on whether the Toolebuc Formation gamma-ray anomaly is present, or absent. In the latter case, a glauconitic sandstone (the Coorikiana Sandstone) generally is developed instead.

3.2. TOOLEBUC FORMATION

Sequences containing the Toolebuc Formation are widespread, extending from Queensland, across northeastern South Australia into the Simpson Desert region. In Queensland, the sequence has been examined by Senior et al. (1978), who recognised the following stratigraphy:

TOP:	Winton Formation
	Mackunda Formation
	Allaru Mudstone
	Toolebuc Formation
BASE:	Wallumbilla Formation

This stratigraphy can also be recognised in the relevant parts of South Australia, and is adopted in this report. Descriptions of the formations are contained in Section 4.

Figure 2: Comparison of old and new stratigraphy - Cretaceous of the southwestern Eromanga Basin

<table>
<tr><th colspan="2" rowspan="2">AGE</th><th colspan="4">NEW NOMENCLATURE</th><th rowspan="2">OLD NOMENCLATURE</th></tr>
<tr><th>Transitional Sequence</th><th>Basin Margin Sequence</th><th>Overlapping Sequence</th><th>Basinal Sequence</th></tr>
<tr><td>LATE CRETACEOUS</td><td>CENOMANIAN</td><td colspan="4" rowspan="2">Winton Formation</td><td rowspan="3">"Winton Formation"</td></tr>
<tr><td rowspan="10">EARLY CRETACEOUS</td><td rowspan="7">ALBIAN</td></tr>
<tr><td colspan="4">Mackunda Formation</td></tr>
<tr><td rowspan="6">Marree Subgroup</td><td rowspan="3">Oodnadatta Formation</td><td colspan="2">Allaru Mudstone</td><td>"Tambo Formation"</td></tr>
<tr><td colspan="2">Toolebuc Formation</td><td>"Toolebuc Member"</td></tr>
<tr><td rowspan="4">Wallumbilla Formation</td><td rowspan="4">"Roma Formation"</td></tr>
<tr><td colspan="2">Coorikiana Sandstone</td></tr>
<tr><td colspan="2" rowspan="2">Bulldog Shale</td></tr>
<tr><td rowspan="2">APTIAN</td></tr>
<tr><td colspan="4" rowspan="2">"Transition Beds" or Cadna-Owie Formation</td><td rowspan="2">"Transition Beds"</td></tr>
<tr><td>NEOCOMIAN</td></tr>
</table>

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3.3. COORIKIANA SEQUENCE

A prominent feature of the Cretaceous sequence in the southern Cooper Basin area is the development of a coarsening-upward cycle of glauconitic sandstone, up to 60 feet thick, just above the Aptian-Albian boundary. In the few instances where the greensand and the Toolebuc Formation are both present in the one section, the Toolebuc gamma-ray anomaly generally occurs about 200-300 feet stratigraphically above the sandstone.

The glauconitic sandstone is very widespread, occurring along the southern margin of the Nappamerri Trough in an east-west direction for nearly 250 km, and extending southwards from there. For example, it is developed in the Moomba, Big Lake, Namur, Della, Dullingari and Toolachee Fields and extends eastwards into Queensland as a continuous unit at least as far as Ashby-1 and Naryilco-1. Due to its widespread and continuous development in this area and its stratigraphic position in the sequence near the Aptian-Albian boundary, it is believed that the unit correlates with the Coorikiana Sandstone* in outcrop areas to the west and southwest. It is only 80 km from Lake Hope -1 (where the glauconitic sandstone occurs in the subsurface) to Kopperamanna Bore where Townsend (1971) identified Coorikiana Sandstone from cuttings and electric logs. From Kopperamanna Bore it is a further 80 km to the Marree-Lake Eyre South region, where the Coorikiana Sandstone occurs in outcrop (Thompson, 1980). Thence, from Marree to the Musgrave Ranges, there are approximately 600 km of outcrop of Coorikiana Sandstone around the margins of the Eromanga Basin.

Recognition of the Coorikiana Sandstone in the subsurface allows a link to be made between the subsurface and the South Australian basin outcrops. This is important since:

(a) it provides a link between the South Australian outcrops of the Aptian-Albian and the rest of the Eromanga Basin - a link not previously available;

(b) it allows formation names to be extended from outcrop areas into the subsurface, thus avoiding the introduction of a new suite of stratigraphic names.

As noted by Ludbrook (1966) and other workers, there is very little lithological variation in the Aptian-Albian marine shale sequence. Thus, recognition of the Allaru Mudstone and Wallumbilla Formation depends largely upon recognition of the thin Toolebuc Formation which separates these two units. Similarly, where the Coorikiana Sandstone is present, the marine shale-siltstone sequence can be subdivided into the Oodnadatta Formation above and the Bulldog Shale below (Thompson, 1980 and Figure 3).

In the subsurface, the sandy section overlying the Oodnadatta Formation is clearly discernable, and can be subdivided into two units, corresponding to the Winton and Mackunda Formations as defined in adjacent wells. This subdivision contrasts with South Australian outcrop nomenclature, where the sandy section overlying the Oodnadatta Formation is unsubdivided and referred to loosely as the 'Winton Formation'. It is clear from the results of this work that the term 'Winton Formation', as used in outcrop areas of central northern South Australia, correlates with both the Winton and

*Footnote: A full explanation of the present usage of the term 'Coorikiana Sandstone' is contained in Section 4.

Mackunda Formations in Queensland. This opinion has previously been expressed by Forbes (1966) and Williams and Youngs (1975).

In summary, the following subsurface stratigraphy can be applied to areas where the Coorikiana Sandstone is developed:

TOP:	Winton Formation
	Mackunda Formation
	Oodnadatta Formation
	Coorikiana Sandstone
BASE:	Bulldog Shale

3.4 OVERLAPPING SEQUENCES

Although the Toolebuc Formation and the Coorikiana Sandstone are generally mutually exclusive, there are a few areas where these two sequences overlap.

In these instances, (such as the Lake Hope-1, Tindilpie-1, and parts of Gidgealpa), the stratigraphic nomenclature also overlaps. Thus the sequence is:

TOP:	Winton Formation	Basinal sequence
	Mackunda Formation	
	Allaru Mudstone	
	Toolebuc Formation	
	Oodnadatta Formation	Basin-margin sequence
	Coorikiana Sandstone	
BASE:	Bulldog Shale	

3.5 SEQUENCES DEVOID OF BOTH TOOLEBUC FORMATION AND COORIKIANA SANDSTONE

There are also a few basin-margin areas where both the Toolebuc Formation and the Coorikiana Sandstone are absent. This situation was first recognised in the Marree area where Ludbrook (1966) coined the name 'Marree Formation' for the undifferentiated sequence of Aptian-Albian marine shale. The 'Marree Formation' was later elevated to subgroup status and used in reference to the sequence from the top of the Oodnadatta Formation to the base of the Bulldog Shale. Thus, in areas where both the Toolebuc Formation and Coorikiana Sandstone are absent, the following stratigraphic nomenclature is observed:

TOP:	Winton Formation
	Mackunda Formation
BASE:	Marree Subgroup

4. DEFINITION AND AGE OF UNITS

4.1 CAINOZOIC COVER ROCKS

Cainozoic sediments overlie the Winton Formation mainly in South Australia, and particularly in the Simpson Desert-Lake Eyre region, where they may be up to 500-600 ft thick. The sequence has a complex stratigraphy, and is assigned to the Birdsville Basin (Veevers and Rundle 1979).

The Birdsville Basin was originally proposed from plate tectonic considerations to distinguish a basin of Cainozoic deposition from the underlying Mesozoic Eromanga Basin. Sediments include the Palaeocene-Eocene Eyre Formation (Wopfner et al., 1974), the Tertiary Mount Sarah Sandstone (Barnes and Pitt, 1977), assorted silcretes and a variety of Quaternary clastic rocks. No attempt is made in this study to resolve the sequence or distinguish it from the underlying Winton Formation.

In many of the recent well completion reports distributed by Delhi Petroleum Pty. Ltd., the Cainozoic and Winton Formation are undifferentiated. In other reports, it has been possible to recognise fluviatile and aeolian sandstones of interpreted Cainozoic age, and separate them from the Winton Formation. It is emphasised however, that the Cainozoic can rarely be recognised with any confidence on electric logs; indeed our major basis for distinguishing the Cainozoic sediments is their distinctive lithology as noted from cuttings samples. It is therefore unlikely that the Cainozoic-Winton Formation unconformity will ever be undisputably established in the study area, using present techniques.

4.2 WINTON FORMATION

The Winton Formation (originally the Winton Series of Dunstan, 1916) is a sequence of grey shale and siltstone with sandstone and minor coal interbeds. It rests conformably on the MacKunda Formation and is overlain unconformably by Cainozoic sediments of the Birdsville Basin. The type area, designated by Whitehouse (1955, p 10) was described as:

> "the blue shales and sandstones with intercalated coal seams met with in the bores in and about Winton."

The Winton Formation occurs as outcrop or shallow subcrop over large parts of southwestern Queensland and extends into South Australia and the Northern Territory. In P.E.L. 5 and 6 in South Australia it is generally buried beneath a cover of Cainozoic sediments. It reaches its maximum measured thickness of over 3000 ft in the Nappamerri Trough (Wiltshire, 1971). Thicknesses approaching 3000 ft for the Winton Formation are also recorded from the Simpson Desert region, adjacent to the S.A.-N.T. border (Richards, 1981).

The name "Winton Formation" has also been loosely applied to outcrops in South Australia along the margins of the Eromanga Basin, from the Dalhousie region (Krieg, in press), through the Oodnadatta region to Lake Eyre (Thompson, 1980). In these outcrop areas, coals and carbonaceous shales are absent, and the "Winton Formation" as mapped consists of interbedded shale-siltstone and sandstone. Kreig (in press) correlates the "Winton Formation" as mapped in outcrop in South Australia with the Winton and Mackunda Formations as defined in their type sections in Queensland.

It is the author's opinion that the South Australian outcrops of "Winton Formation" more correctly equate on lithological grounds with the Mackunda Formation, and that the Winton Formation sensu stricto ~~strata~~ may be absent or at least very much more resticted in outcrop in South Australia. This is not to say that the type Winton Formation does not have a time equivalent in outcrop in South Australia, but rather that there is probably a facies change from carbonaceous and coally sediments in the subsurface to non-carbonaceous sandy units near the Eromanga Basin margins.

Unfortunately however, the South Australian usage of the term "Winton Formation" is so entrenched in the literature that it is unlikely to be altered in the near future.

For the present, what is most important to realise is that the outcropping "Winton Formation" in South Australia is not the same as the Winton Formation as used in the subsurface, and as defined in the type area around Winton.

The Winton Formation is late Albian to Cenomanian in age (ie Early to Late Cretaceous), based mainly on the presence of Cenomanian angiosperm leaves (White, 1966, 1974) and post-K2b palynomorphs (Burger in Exon et al, 1972). Fossils recovered from the formation include fragmentary plant material, fossil wood, freshwater bivalves, unionids, lungfish and dinosaur remains (Senior et al, 1978; Coombs and Molnar, 1981; Vine and Day, 1965; White, 1962, 1964).

The environment of deposition of the Winton Formation is non-marine, generally low-energy meandering-fluvial to paludal.

4.3 MACKUNDA FORMATION

The Mackunda Formation (Vine and Day, 1965) lies conformably below the Winton Formation. It comprises interbedded shale, siltstone and sandstone which is calcareous in part. It is distinguished from the overlying Winton Formation by:

(a) a slightly more sandy aspect
(b) an absence of coal beds
and (c) a marine fauna

It is difficult and often impossible to distinguish the Winton and Mackunda formations using the gamma-ray log alone. The best basis for making the log pick is by using the gamma-ray sonic (or SLS) log, where the sudden presence of coal or very carbonaceous shale passing upwards in the section is marked by a very distinctive change in sonic character.

The Mackunda Formation averages 200 ft in thick~~ens~~ness in the central Eromanga Basin (Senior et al, 1978) and thick~~ness~~ens to 300-400 ft in the southwestern Eromanga Basin. Sand development in this uppermost marine Cretaceous section is somewhat erratic, so thickness changes are also erratic and difficult to predict. However, the unit is clearly distinguishable throughout most of the southwestern Eromanga Basin in the subsurface, maintaining a thickness in the order of 300-400 feet.

The Mackunda Formation is upper Albian (Lower Cretaceous) in age, based mainly on a K2 microflora (Burger, 1968). The macrofossil fauna consists of bivalves, ammonites, gastropods, belemnites, polyzoans, shark teeth and wood fragments (Day, 1966, 1967, 1968, 1969; Day in Gregory et al., 1967). Dinosaur remains are reported by Bartholomai and Molnar (1981).

Faunal data from the Delhi-Santos licence areas in South Australia and Queensland are as yet sparse, and it is not known whether the Mackunda Formation has marine affinites throughout the area. Certainly the equivalent section in the Marree area~~s~~ (the lower part of the Blanchewater Formation) contains Albian marine fossils (Ludbrook, 1966).

The environment of deposition is marginal marine representing a "transition of paralic sedimentation between the marine Allaru Mudstone and the non-marine Winton Formation "(Senior et al, 1978, p. 15).

4.4. ALLARU MUDSTONE

The Allaru Mudstone, originally assigned to the upper part of the Wilgunya Formation (Casey, 1959), was termed the Allaru Member of Vine and Day (1965), before finally being elevated to ormation status by Vine et al, (1967). Its type section occurs along the main Richmond-Winton road on the Richmond Sheet in Queensland. The formation comprises mainly grey mudstone with thin interbeds of calcareous siltstones, and minor very fine-grained sandstone. Thin concretionary limestones are also reported from the sequence.

The Allaru Mudstone is overlain conformably by the Mackunda Formation, and is underlain conformably by the Toolebuc Formation. It is Albian (Early Cretaceous) in age based on its varied fossil content and the age of adjacent sequences. Marine fossils include bivalves, ammonites, gastropods and belemnites (Day, 1966, 1968, 1969). Microplankton and a K2 microflora are also recorded (Burger, 1968).

The sequence is shallow, quiet water marine in origin. It is a lateral equivalent of the middle and upper parts of the lithologically indistinguishable Oodnadatta Formation (Freytag, 1966), defined in outcrop areas of South Australia.

Maximum thickness of the Allaru Mudstone reported by Senior et. al., (1978) is 270 m (885 ft), in outcrop. The formation thins onto the major basement ridges, but thickens again over the Cooper Basin. A maximum thickness of 945 ft is recorded at Burley No. 1, on the flank~~s~~ of the Nappamerri Trough.

4.5 TOOLEBUC FORMATION

The Toolebuc Formation was originally defined as a member of the Wilgunya Formation. It was later referred to as the Toolebuc Limestone (Vine et al., 1967) and was finally named the Toolebuc Formation by Senior et al., (1975), who designated a type section in BMR Boulia No. 3A in Queensland. It comprises dominantly dark grey to black siltstone and mudstone with subordinate limestone (including coquinite). In most of the Delhi-Santos licence areas, limestone is absent from the formation, generally supporting Senior et al.'s (1975, p. 451) view that "limestone ... is absent in southwestern Queensland."

The Toolebuc Formation is overlain conformably by the Allaru Mudstone, and conformably overlies the Wallumbilla Formation. Formation boundaries are taken to correspond with the top and bottom of the gamma-ray log anomaly. The formation is Albian (Early Cretaceous) in age and contains abundant sessile bivalves (particularly Inoceramus and Aucellina)as well as fish fragments, gastropods, belemnites, radiolarians, Globigerina and dinoflagellates (Day, 1966, 1968, 1969; Terpstra, 1967; Vine and Day, 1965; Burger, 1981). A K2a microflora supports an Albian age (Evans and Burger in Exon et al., 1972). Vertebrate remains are reported by Casey (1959) and Vine and Day (1965).
The Toolebuc Formation has received considerable attention over the years because:

(a) its has a strong positive gamma-ray anomaly, making it an excellent tool for correlation

(b) it is a thin and laterally persistent unit

and (c) it is rich in organic matter in some areas, making it an attractive target for oil shale exploration (Herbert, 1980; Halyburton, 1980; Ozimic, 1981).

The formations varies from a few feet up to 246 ft (75 m) in thickness (Senior et al., 1978). In the Delhi-Santos licence areas it has a maximum recorded thickness of 170 ft at Putamurdie No. 1 on the Birdsville Track Ridge. Considerable thicknesses are also recorded in the Simpson Desert Region and in the northern part of ATP 259P in Queensland.

The gamma-ray anomaly associated with the Toolebuc Formation has been traced by the author from southwestern Queesland into South Australia. It is absent from the southern part of the Nappamerri Trough and south thereof (eg Big Lake - Della - Toolachee - Epsilon areas) ~~is~~ due to a facies change, whereas it is the upper of several visually-similar gamma-ray anomalies in the Patchawarra Trough. This latter observation supports the opinion of Herbert (1980) and Burger (1981) that caution should be exercised before applying the name 'Toolebuc Formation' to Early Cretaceous gamma-ray anomalies.

The anomaly in ATP 259P however, is quite marked, and correlates with the Toolebuc Formation as mapped in the subsurface (Senior et al., 1978). In Morney No. 1, thirty one sidewall cores were shot at two foot intervals to examine the nature of the Toolebuc Formation. The results of this study are discussed by Moore (1981a, b) and are summarised elsewhere. In nearby Gilpeppee No. 2, attempts were made to obtain full hole cores of the Toolebuc Formation, this being only partly successful (Thornton and Elliott, 1982). Results include:

(a) confirmation that the Toolebuc gamma-ray anomaly is associated with a dark grey to black calcareous mudstone (or marl).

(b) confirmation that high sonic velocities are associated with concentrations of shell material, particularly Inoceramus and Aucellina

(c) indentification of a distinctive black marl facies (containing fish scales and other fossil fragments) associated with the maximum gamma-ray deflection.

Fossils indentified from the Toolebuc Formation in Gilpeppee No. 2 (Core No. 1; 4207' - 4213') are (Ludbrook, written comm.):

Inoceramus sutherlandi (McCoy)
Cyrenopsis corrugata (Tate)
Pseudavicula sp. nov. of Ludbrook (1966)
Syncyclonema gradata (Etheridge jr)
Aucellina Hughendenensis (Etheridge)
Fish scales

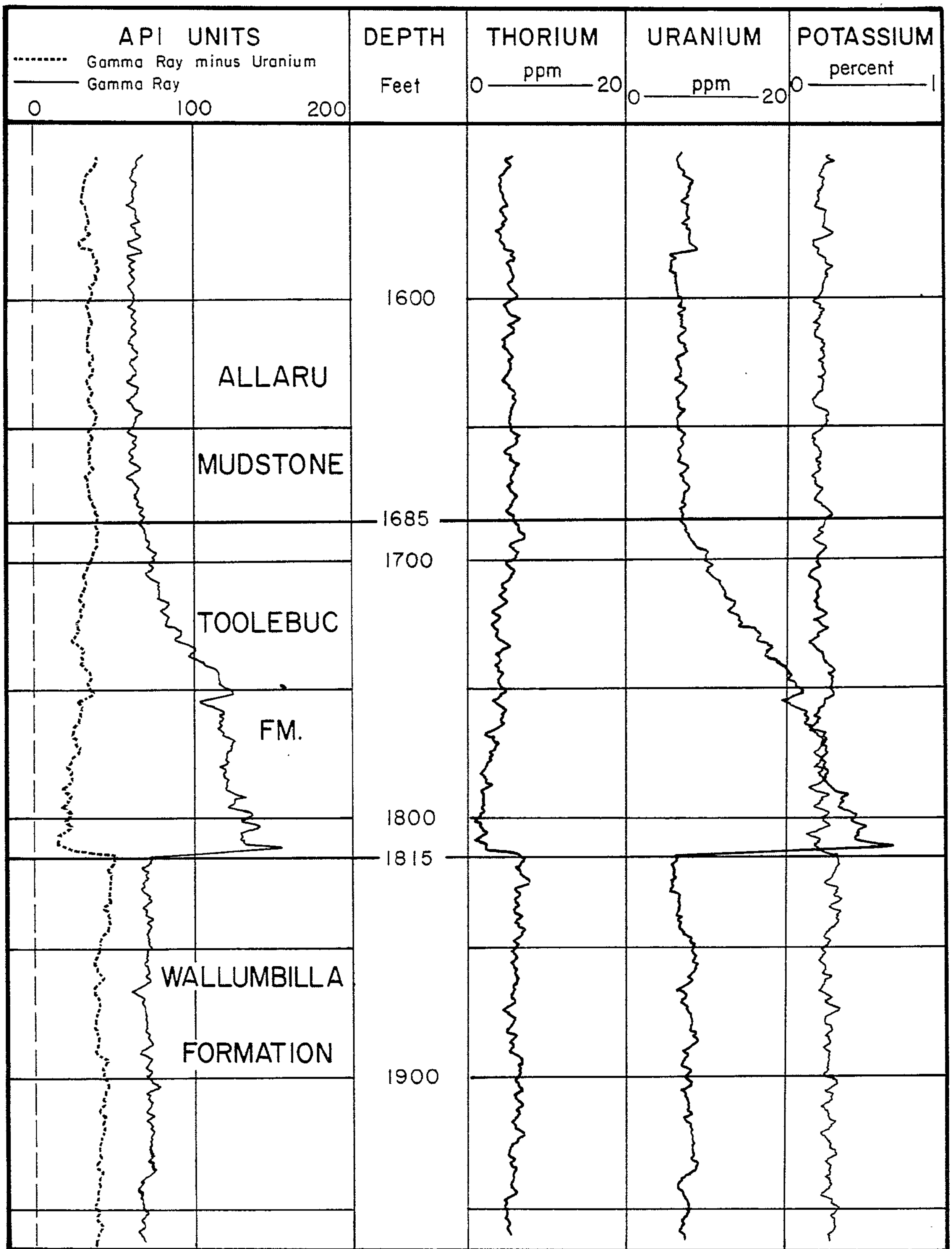
Fossils identified from sidewall cores in Morney No. 1 are (Scheibnerova, written comm.):

Hedbergella sp. (a planktonic foraminifera - common)
Ammodiscus sp. (an agglutinated foraminifera - one specimen only)
Fish scales, teeth and bone fragments

The Toolebuc Formation was deposited under shallow marine conditions. Exon and Senior (1976) suggest an oceanic connection to the north, with shales laid down under reducing conditions, and limestones (where present) developed as bioherms. The shelly macrofauna is dominated by large sessile pelecypods (eg. Inoceramus and Aucellina) suggesting a shallow water, marine environment with a firm substrate. Swarms of the planktonic foraminifer Globigerina (Crespin, 1963) indicate periodic connection with the open sea.

The gamma-ray anomaly which characterises the Toolebuc Formation has been attributed to a variety of causes (eg. Senior et al., 1975, p. 452). Most recently Ozimic (1981), quoting the work of Ramsden (1980) and Ramsden et al. (1980), stated that the anomaly is due to a high uranium count, the uranium being associated with both carbonaceous matter and phosphatic fish remains. This relationship has been confirmed by running a NGS (Natural Gamma Spectroscopy) tool in Curalle 1, Paning 1, Wareena -1 and Innamincka -3. An example of the results obtained is shown in Figure 3.

NATURAL GAMMA RAY SPECTROSCOPY LOG
TOOLEBUC FM., WAREENA No.1, QUEENSLAND



Dwg. No. 82XG-1338 File 0-42

FIGURE 3

In most wells where the Toolebuc Formation is well developed in the Delhi-Santos licence areas, the gamma ray anomaly has a relatively sharp base and a gradational top. It is suggested that the facies (and thus the anomaly) result from a sudden rise in sea level, with minimal deposition following the transgression. Instead, a firm substrate developed on which organisms lived and died and organic matter accumulated. With time and possibly a minor regression, sedimentation resumed, forming the transitional top to the Toolebuc Formation. Around the basin margins, the sediment supply was more continuous and the Toolebuc Formation was either poorly developed or absent.

4.6 WALLUMBILLA FORMATION

The Wallumbilla Formation was defined by Vine et al., (1967). It had previously been referred to as the "Wollumbilla Formation" by Clarke (1865) and was included as the lower part of Casey's (1959) Wilgunya Formation. The unit varies considerably in thickness, from less than 100 ft (30 m) in some outcrops in the far north western part of the Eromanga Basin (Senior et al., 1978) to over 1400 ft in the central Nappamerri Trough in South Australia. It is overlain conformably by the Toolebuc Formation and rests conformably on the Cadna-Owie Formation (otherwise known as the "Transition Beds" in the Delhi-Santos licence area). The type section is in Wallumbilla Creek, in the Roma area of Queensland.

The Wallumbilla Formation consists of grey mudstone and siltstone with minor interbeds of fine sandstone. Senior et al., (1978) report rare, thin cone-in-cone limestone and intraformational conglomerates. The unit is calcareous in part~~s~~, and may contain glauconite. Inoceramus fragments are common in the upper part of the unit (Casey et al., 1960).

An Aptian to Albian age (Early Cretaceous) is assigned to the Wallumbilla Formation on the basis of a rich marine fauna, including bivalves, gastropods, belemnites, scaphopods, ammonites, brachiopods, crinoids, foraminiferids, radiolarians, ostracods, diatoms, dinoflagellates, acritarchs, spores, pollen, plant debris and fossil wood (Clarke, 1862, 1867; Moore, 1870; Vine and Day, 1965; Day, 1964, 1966, 1967, 1969; Vine et al., 1967; Senior et al., 1969; Jensen et al., 1976; Haig and Barnabaum, 1978). Palynological zones from K1b to K2a have been recorded in the formation (Burger in Senior et al., 1969).

Four members have been defined in the Wallumbilla Formation, with the Ranmoor and Jones Valley Members (Vine and Day, 1965) being confined to the northern portions of the Eromanga Basin, in Queensland. In the southwestern Eromanga Basin, the Wallumbilla Formation can be divided into an upper, slightly sandy member (the Coreena Member of Vine, 1966) and a lower, shaley member (the Doncaster Member of Vine and Day, 1965). While this general subdivision is apparent in P.E.L. 5 and 6 and particularly ATP 259P, the members are not easily mapped using gamma-sonic logs, and no attempt is made to distinguish the members in this report.

The Wallumbilla Formation was deposited in a shallow epicontinental marine to paralic environment, as indicated by the marine fossil types and their association with plant debris, fossil wood and terrestrial vertebrates. Haig and Barnbaum (1978) envisage a cool temperate climate and hyposaline shallow water conditions during deposition of the Doncaster Member.

4.7 SOUTH AUSTRALIAN BASIN MARGIN NOMENCLATURE - GENERAL

When mapping of the South Australian margins of the Eromanga Basin commenced, it was felt that there were changes in sedimentation associated with the marginal environment. Local rock-unit classification was therefore necessary.

Mapping was initiated in two areas, one near Oodnadatta (Freytag, 1966; Ludbrook, 1966; Freytag et al., 1967) and the other near Marree (Forbes et al., 1965; Forbes, 1966). As a result, two different sets of names arose to describe a very similar sequence. In order to simplify this nomenclature, the Marree Formation was elevated to subgroup status (Thomspon, 1980) and the term 'Attraction Hill Member' was abandoned in preference for the more widely mapped and laterally equivalent CoorikianaSandstone (Thompson, 1980). As the nomenclature now stands, it is relatively consistent and coherent around the southwestern basin margins.

Correlation into the subsurface has been difficult, the difficulty being compounded by a lack of suitably logged and described wells in the critical areas, and lateral facies changes. However, one unit that is laterally very extensive is represented by the Coorikiana sandstones, which extend from Oodnadatta, through Marree, into the subsurface in the Della-Dullingari-Toolachee area. Thus, the Coorikiana sandstones from an important link between the basin margin outcrops and the subsurface.

This report incorporates a slight modification of the basin margin stratigraphy as originally proposed by Freytag (1966). The Coorikiana Member is elevated to formation status and thus separated from the overlying Oodnadatta Formation. This modification is a necessary result of our greater understanding of the nature of the Coorikiana sandstones and their mode of deposition.

4.8 OODNADATTA FORMATION

The Oodnadatta Formation was defined by Freytag (1966), prior to use on the OODNADATTA Sheet (Freytag et al., 1967). The formation was described as consisting predominantly of shale and siltstone, with minor sandstone and uncommon limestone interbeds. It is approximately 460 feet thick in its type section at Mount Arthur, where it has an eroded top.

Several members were defined in the type Oodnadatta Formation (Freytag, 1966). In the upper portion, an interval of glauconitic sandstone is known as the Mount Alexander Sandstone Member. This member is considered to be a lateral equivalent of both the Mackunda

Mount

Formation (Vine and Day, 1965) and also the Blanchewater Formation (Forbes, 1966), based on its lithological affinites and also on the distribution of foraminifera (Scheibnerova, 1980). In the Dalhousie region, the Alexander Sandstone Member is not recognised. There are two explanations of this; either the facies is absent, or it has been included in the basal "Winton Formation" (Kreig,in press). Ludbrook (1966, p. 27) identified a restricted marine fauna in the Mount Alexander Sandstone Member at Oodnadatta No. 1. The fauna consists mainly of arenaceous foraminifera and fish teeth, but included plant debris.

In the lower portion of the Oodnadatta Formation, a thin unit of calcareous siltstone with concretionary limestone interbeds is known as the Wooldridge Limestone Member. This unit has been correlated with the Toolebuc Formation in the central and eastern Eromanga Basin (Day, 1966; Freytag, 1966; Dettman and Playford, 1969; Smart, 1972; Exon and Senior, 1976; Scheibnerova 1980). It contains abundant ammonites (Reyment, 1964a 1964 b) as well as large molluscs, belemnites and foraminifera (Ludbrook, 1966). It is considered likely that the limestone nodules which characterise the Wooldridge Limestone Member are a surface weathering feature, and that the lithology is quite different in the subsurface. Similar behaviour in the Toolebuc Formation in Queensland caused Vine et al., (1967) to initially refer to the unit as the "Toolebuc Limestone". The age of the Wooldridge Limestone is Late Albian.

Freytag (1966) defined the base of the Oodnadatta Formation as the base of a thin glauconitic sandstone which he termed the Coorikiana Member. The Coorikiana Member is here elevated to formation status, and excluded from the overlying Oodnadatta Formation. Thus, in outcrop around Oodnadatta, the Oodnadatta Formation is now defined as lying conformably between the 'Winton Formation' (above) and the Coorikiana Sandstone (below). In the subsurface where the Mackunda Formation is recognised, the Oodnadatta Formation is defined as lying conformably between the Mackunda Formation and the Coorikiana Sandstone.

The age of the Oodnadatta Formation is generally considered to be Early to Late Albian (Ludbrook, 1966, 1978; McNamara, 1980) based on its ammonite fauna. Ammonites form a much less important part of the marine Cretaceous fauna of the Eromanga Basin in South Australia than in Queensland, presumably due to the more restricted conditions. The fauna has been described principally by Etheridge (1905), Brunnschweiler (1959), Reyment (1964a, b), Ludbrook (1966) and McNamara (1980). In addition, the formation contains bivalves, gastropods, nautiloids, belemnoides brachiopods, foraminifera, ostrocods, radiolaria, echinoids, fish fragments, spores and plant debris (Ludbrook, 1966).

The Oodnadatta Formation was deposited under low energy, marine conditions. Transgression and regressions occurred during deposition, influencing the composition of the fauna (Morgan, 1980). However, shallow water conditions are thought to have predominated.

4.9 COORIKIANA SANDSTONE

In the original definition of the Oodnadatta Formation, Freytag (1966) defined the base as the bottom of a richly glauconitic and sandy interval which he termed the Coorikiana Member. Thickness of the Coorikiana Member was given as 25 feet (8 m) in Oodnadatta No. 1.

Subsequent mapping of the Coorikiana interval was carried out over a large area, which included the Oodnadatta, Curdimurka, Wintinna, Warrina and Nooleyeana 1:250 000 sheet areas. Detailed mapping of the unit was made difficult by poor, discontinuous outcrop and very low dip. However, a general increase in thickness to the west was recognised and, since the unit was predominantly a sandstone throughout its area of outcrop, it was renamed the Coorikiana Sandstone Member (Pitt and Barnes, 1973 ; Kreig, in press).

As the wide distribution of the Coorikiana sandstones was realised, it became apparent that Forbes' (1966) Attraction Hill Sandstone Member in the Marree area was probably a lateral equivalent, and that the Coorikiana sandstones extend at least as far east as Marree. This is best demonstrated on the 1:1,000,000 scale State Geological Map, where Thompson (1980) has referred to the unit throughout its outcrop as "Coorikiana Sandstone".

The extent of Thompson's (1980) "Coorikiana Sandstone" is approximately 600 km. The unit extends as a continuous belt around the southwestern margin of the Eromanga Basin, representing a nearshore series of sandy marine shoals. Until recently, its extension beyond Maree was unknown. However, Townsend (1971) identified the Coorikiana Sandstone in Kopperamanna Bore, approximately 80 km to the northeast of Marree.

A further 80 km to the east, intense drilling has been carried out by Delhi-Santos and partners, in their search for hydrocarbons. Throughout the southern part of this area, the monotony of the Aptian-Albian marine mudstone sequence is interrupted by a single, thick, highly glauconitic sandstone. Its position in the succession, approximately 250-300 feet stratigraphically below the Toolebuc Formation, places it adjacent to the Aptian-Albian boundary, strongly suggesting that this unit is the lateral extension of the Coorikiana sandstones. In the Delhi-Santos licence areas, the glauconitic sandstone has been mapped as a continuous unit from Lake Hope -1 through Della, Dullingari and Toolachee, to Orientos, Ashby and Naryilco in Queensland; a total distance of over 200 km. The unit lenses out north and south, but shows little variation in an east-west direction, parallel to the margins of the Eromanga Basin.

The discovery of this widespread, glauconitic sandstone unit in the subsurface allows a much better study of its nature, and environment of deposition. In outcrop, the sandstones are poorly exposed, and little interval variation is noted. In the subsurface however, electric logs show a distinctive coarsening-upward character to the unit, relating it genetically to the underlying Bulldog Shale, rather than the overlying Oodnadatta Formation. For this reason, and also because the Coorikiana sandstones are so distinctive and laterally extensive, the unit is herein assigned formation status.

A subsurface reference section for the Coorikiana Sandstone is designated, this being the interval between 3286' and 3330' in Strzelecki No. 5 (Surka, 1982). This well is chosen because:

a) it represents a relatively thick section of the formation (44'),

b) it is relatively central to the areas of subcrop

& c) it shows the well-developed coarsening-upward character that is a feature of the formation in the subsurface

The Coorikiana Sandstone, as defined in Strzelecki -5, consists of sandstone with minor siltstone interbeds. The sandstone is greenish white to grey, very fine to fine-grained, moderately sorted with a calcareous cement and argillaceous matrix. Glauconite is abundant. The siltstone is grey to dark brown, and is argillaceous and carbonaceous in parts. A low to moderate energy, shallow marine environment is interpreted for the formation.

In Oodnadatta No. 1, the Coorikiana Sandstone contains the brachiopod Australiarcula artesiana, holothurians and worm burrows, and has been assigned an Early Albian age (Ludbrook, 1966). Palynological examination of the sequence generally supports this age (Dettman, 1963; Dettmann and Playford, 1969), although Scheibnerova and Byrnes (1977) and Scheibnerova (1980) argue for a much younger (Late Albian) dating, based on foraminiferal correlations. It should be noted here that there is minimal disagreement between the various workers regarding lithostratigraphic correlations; the arguments are mainly confined to the position of the Aptian-Albian boundary within the sequence. Palynological dating is presently being carried out on the subsurface sections, however, no results are available at this stage.

4.10 BULLDOG SHALE

The Bulldog Shale was defined by Freytag (1966), who measured a type section five miles south of Bulldog Creek, on the eastern side of the Peake and Denison Ranges. Lithology in outcrop is dark grey fossiliferous shale, with concretionary limestones and rare coquinoid layers. Fossil wood fragments often impregnated with pyrite are common in the lower portion.

The Bulldog Formation extends into the subsurface, and is 560 feet thick in nearby Oodnadatta No. 1. It is overlain conformably by the Coorikiana Sandstone and rests conformably on the Cadna-Owie Formation ("Transition Beds" of Delhi Petroleum and associates). The formation reaches its maximum known thickness of approximately 1000 ft on the southern flanks of the Nappamerri Trough, in the southern Cooper Basin region. It is lithologically undistinguishable from the laterally adjacent Wallumbilla Formation.

The age of the Bulldog Shale is generally considered to be Aptian, to early Albian with the Aptian-Albian boundary occuring in the upper portion of the Bulldog Shale (Ludbrook, 1966, 1978). Fossils encountered in the unit include bivalves, gastropods, cephalopods, belemnites, brachiopods, foraminifera, radiolaria, ostrocods, wood fragments, vertebrate remains, fish fragments and echinoids (Ludbrook, 1966; Freytag, 1964). Scheibnerova and Byrnes (1977) and Scheibnerova (1980) have suggested that the upper part of the formation is Albian in age based on foraminiferal correlations.

Subsurface occurrences of the Bulldog Shale are lithologically similar to those in the outcrop areas. Thin calcareous interbeds are probably concretions, rather than laterally continuous horizons. The lower one third of the formation is particularly shaley and dark coloured, as noted by Freytag (1966) from outcrop areas. This unit is probably a lateral facies equivalent of the Doncaster Member of the Wallumbilla Formation.

The Bulldog Shale was deposited in a shallow-water marine environment. Regression occurred in the early Albian, with the overlying Coorikiana Sandstone representing shallow marine shelf sedimentation. Lingula and arenaceous foraminifera are common in this latter unit.

5. APPLICATIONS OF THE DATA

This report presents a synthesis of the basic data regarding the Cretaceous of our licence area. Various applications of these data are possible, some of which will be presented in a subsequent report. The main applications are:

(1) Stratigraphic - prediction of Cretaceous stratigraphy in various exploration wells

(2) Sedimentology - prediction of facies changes from area to area, such as predicting where the thickest and cleanest sands occur within the Coorikiana Sandstone

(3) Structural - prediction of the timing of uplift in areas, and the amount of post-Cretaceous erosion in certain parts of the basin. Examples of this are the marked thinning of the Bulldog shale over the Della Field, and the thin sequence of Winton Formation preserved in Wareena and Jackson, indicating late stage erosion of the sequence in these areas

(4) Seismic - correlation of the "Toolebuc" and "Coorikiana" reflectors with lithological events, providing a means of cross-checking the seismic results.

Some of these applications and results of specific studies will be presented in subsequent reports.

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PART B

FORMATION TOPS

1. INTRODUCTION

The following formation tops are divided into 4 groups:

(a) Basinal facies, containing the Toolebuc Fm.

(b) Marginal facies, containing the Coorikiana Sst.

(c) Mixed facies, containing both the Toolebuc Fm. and Coorikiana Sst.

(d) Transitional facies, containing neither Toolebuc Fm. nor Coorikiana Sst.

Several principles have been applied in picking the formation tops wich should be remembered:

(a) No attempt has been made to differentiate the Winton Formation from the overlying Cainozoic sediments. This is best done using the mudlog, and is impossible to do on some of the old wells, where the cuttings were not logged.

(b) The Winton Formation is carbonaceous and coaly and is differentiated from the underlying Mackunda Formation mainly on this basis. The formation boundary cannot be picked with any confidence in wells which do not have a sonic log over this interval.

(c) The Winton-Mackunda boundary is a facies or lithological boundary, and therefore corresponds only approximately to a given log-correlation marker horizon. However, the departure from such an horizon is considered to be small, possibly less than 50 feet in all cases. (ie. the Winton-Mackunda Formation boundary approximates to a consistent log horizon.)

(d) The Mackunda-Allaru formation boundary is extremely gradational representing a change from sandy siltstones to siltstones. In places, the thickness of the MacKunda Formation is strongly facies controlled, giving quite variable isopachs for the unit over relatively short distances.

(e) The Toolebuc Formation is marked by high gamma ray values, the top and the base of the Formation being taken as the first significant departure from the Allaru-Wallumbilla gamma ray values. Thinning of the Toolebuc Formation from north to south is a facies effect, and does not indicate the amount of sedimentation during this period of time.

(f) The Coorikiana Sandstone is picked as a single sandstone unit, as defined in Strzelecki -5. The unit is generally coarsening upwards, and is picked using the gamma-ray log. In a few areas, a second thinner sandstone overlies the main Coorikiana Sandstone, but for simplicity of mapping this second sand is excluded from the Coorikiana Sandstone.

It is pointed out that most of the Aptian-Albian formations are difficult to detect on the wellsite using 30' cuttings samples. However, they are clearly recognisable on the logs and are useful in petroleum evaluation of our licence areas.

While formation tops have been picked for most wells, there are some which have insufficient logs to make reliable picks. In outlying areas, the picks which are now made may be revised with subsequent drilling and an improvement of data.

FORMATION TOPS

As at June, 1982

2A BASINAL SEQUENCE (DEPTH K.B., FEET)

WELL NAME	WINTON FM	MACKUNDA FM	ALLARU MUDSTONE	TOOLEBUC FM	WALLUMBILLA FM	'C'
Adria Downs -1	-	1300	1606	2446	2586	3106
Alkina -1	-	2344	2642	3554	3660	4704
Arrabury -1	-	2826	3113	3744	3772	5185
Ashby -1		BASIN	MARGIN	SEQUENCE		
Barrolka -1	-	(N.S.)	2603	3551	3648	4807
Barrolka East -1	-	2160	2422	3351	3448	4605
Beanbush -1	-	3792	4176	4816	4894	6388
Belah -1		BASIN	MARGIN	SEQUENCE		
Betoota -1	-	?1333	1652	2433	2552	3248
Big Lake 1-27		BASIN	MARGIN	SEQUENCE		
Boorthanna -1		BASIN	MARGIN	SEQUENCE		
Boxwood -1		BASIN	MARGIN	SEQUENCE		
Brolga -1	-	(N.S.)	3560	4342	4410	5660
Brumby -1		BASIN	MARGIN	SEQUENCE		
Burke 1-4		BASIN	MARGIN	SEQUENCE		
Burley -1	-	2904	3123	4068	4092	5430
Cherri -1		BASIN	MARGIN	SEQUENCE		
Coochilara -1		BASIN	MARGIN	SEQUENCE		
Coonatie -1	-	3624	3929	4647	4661	5957
-2	-	3607	3894	4566	4586	5897
Coongie -1	-	2892	3376	3933	4000	5044
Coopers Ck -1	-	3200	3451	4085	4140	5434
Cootanoorina -1		BASIN	MARGIN	SEQUENCE		
Corkwood -1		BASIN	MARGIN	SEQUENCE		
Curalle -1	-	1004	1322	2110	2258	2983
Cutapirrie -1	-	3554	3938	4536	4594	5760
Daralingie 1-4		BASIN	MARGIN	SEQUENCE		
Della 1-16		BASIN	MARGIN	SEQUENCE		
Dilchee 1-2		BASIN	MARGIN	SEQUENCE		
Dilchee West -1		BASIN	MARGIN	SEQUENCE		
Dullingari 1-28		BASIN	MARGIN	SEQUENCE		

WELL NAME	WINTON FM	MACKUNDA FM	ALLARU MUDSTONE	TOOLEBUC FM	WALLUMBILLA FM	'C'
Dullingari Nth 1-3		BASIN MARGIN SEQUENCE				
Durham Downs -1	-	(N.S.)	2658	3437	3482	4693
Epsilon 1-2		BASIN MARGIN SEQUENCE				
Erabena -1	-	?	?	3531	3570	4222
Fly Lake -1	-	3146	3479	4146	4168	5525
Fly Lake -2	-	(N.S.)	3609	4226	4293	5606
-3	-	(N.S.)	3622	4266	4308	5598
-4	NO LOGS ABOVE 'C' HORIZON					
-5	-	3278	3512	4173	4195	5538
-6						
Galway -1	-	2805	3100	4096	4190	4933
Gidgealpa -1	-	3072	3357	3922	3945	5211
-2	-	2629	2916	3462	3518	4677
-3	-	2745	3021	3566	3587	4878
-4	-	2698	2974	3527	3551	4743
-5	NO LOGS ABOVE 6039 FEET					
-6	NO LOGS ABOVE 6127 FEET					
-7	NO LOGS ABOVE 6133 FEET					
-8	-	2725	3006	3561	3585	4778
-9	-	2816	3073	3596	3602	4797
-10	-	2740	2994	3546	3568	4766
-11	-	2671	2970	3456	3486	4692
-12	-	2620	2866	3431	3456	4659
-13	NO LOGS ABOVE 6200 FEET					
-14	-	(N.S.)	2778	3314	3334	4594
-15	-	(N.S.)	2712	3366	3390	4595
-16		BASIN MARGIN SEQUENCE				
-17						
Gilpeppee -1	NO LOGS ABOVE 4074 FEET			4523	4640	5610
-2	-	2940	3273	4174	4292	5232
Gurra -1		BASIN MARGIN SEQUENCE				
Hume -1		BASIN MARGIN SEQUENCE				
Ingella -1	-	2946	3232	4245	4339	5169
Innamincka -1	-	(N.S.)	1897	2606	2638	3937
-2	-	(N.S.)	(N.S.)	2825	2863	4490
-3	-	1612	1823	2425	2457	3726
Jack Lake -1		OVERLAPPING SEQUENCE				
Jackson -1	-	1202	1479	2239	2265	3355
-2		1117	1442	= TOP MARREE SUBGROUP		3384

WELL NAME	WINTON FM	MACKUNDA FM	ALLARU MUDSTONE	TOOLEBUC FM	WALLUMBILLA FM	'C'
Jackson -3	-	1154	1469 = TOP MARREE SUBGROUP			3368
Jackson South -1	-	1252	1548 = TOP MARREE SUBGROUP			3283
Jackson South -2	-	1250	1532 = TOP MARREE SUBGROUP			3281
Kalladeina -1	-	2295	2535	3255	3317	4235
Kanowana -1	-	(N.S.)	?3592	4198	4238	5511
Karmona -1	-	(N.S.)	2467	3252	3328	4550
Kerna 1-2		BASIN	MARGIN	SEQUENCE		
Kidman 1-2		BASIN	MARGIN	SEQUENCE		
Kirby 1	-	2642	2900	3699	3729	5210
Kudrieke -1	-	3653	3992	4703	4738	5930
Kumbarie -1		BASIN	MARGIN	SEQUENCE		
Kuncherinna -1	-	?2693	?	4188	4333	5111
Lake Frome 1-3		BASIN	MARGIN	SEQUENCE		
Lake Hope -1		OVERLAPPING	SEQUENCE			
Macumba -1	-	2764	3104	3771	3868	4670
Marabooka 1-2		BASIN	MARGIN	SEQUENCE		
McKinlay 1-2		BASIN	MARGIN	SEQUENCE		
Merrimelia -1	-	3010	3250			5157
-2	-	3030	3280			5172
-3	-	2932	3236	3810	3830	5074
-4	-	2805	3196			5087
-5	-	(N.S.)	3200	3734	3777	5007
-6	-	2745	3054 = TOP MARREE SUBGROUP			4833
-7	-	2884	3185	3729	3744	4942
-8	-	2876	3189	3758	3768	4874
-9	-	2808	3143	3702	3722	4948
Mitchie -1	-	3636	4010	4734	4767	5937
Mokari -1	-	2344	2750	3178	3214	3913
Moomba 1-46		BASIN	MARGIN	SEQUENCE		
Moorari -1	-	3412	3764	4427	4456	5716
-2	-	(N.S.)	3833	4530	4551	5818
-3	-	3392	3716	4364	4395	5715
-4	-	3402	3758	4422	4454	5744
Morney -1	-	1126	1378	2375	2464	3173
Mt. Crispe -1	-	?	?	424	434	610
Mt. Howitt -1	-	1114	1362	2192	2287	3290
Mudera -1		BASIN	MARGIN	SEQUENCE		
Mudlalee 1-2		BASIN	MARGIN	SEQUENCE		
Mudrangie -1	-	(N.S.)	3916	4658	4672	5714

WELL NAME	WINTON FM	MACKUNDA FM	ALLARU MUDSTONE	TOOLEBUC FM	WALLUMBILLA FM	'C'
Mudrangie -2	-	(N.S.)	3653	4320	4352	5694
Mulga -1		BASIN	MARGIN	SEQUENCE		
Munkarie 1-3		BASIN	MARGIN	SEQUENCE		
Murteree 1, A-1, C-1		BASIN	MARGIN	SEQUENCE		
Naccowlah -1	-	1864	2220	2981	3042	4090
Namur 1-2		BASIN	MARGIN	SEQUENCE		
Nappacoongie 1-2		BASIN	MARGIN	SEQUENCE		
Narcoonowie -1		BASIN	MARGIN	SEQUENCE		
Naryilco -1		BASIN	MARGIN	SEQUENCE		
Orientos -1		BASIN	MARGIN	SEQUENCE		
Orientos North -1		BASIN	MARGIN	SEQUENCE		
Packsaddle -1		NO LOGS	ABOVE	4300	FEET	
-2	-	2646	2906	3442	3492	4808
-3	-	2460	2646	3342	3380	4514
Pandieburra -1	-	?	?	3370	3490	4174
Pando 1-2		BASIN	MARGIN	SEQUENCE		
Pando North -1		BASIN	MARGIN	SEQUENCE		
Paning -1	-	2833	3224	3912	3947	5344
Pelketa -1		BASIN	MARGIN	SEQUENCE		
Pinna -1		BASIN	MARGIN	SEQUENCE		
Poolowanna -1	-	?	?	4200	4343	5186
Poonarunna -1	-	1913	2183	2900	2932	3823
Purni -1	-	1646	2054	2554	2591	3218
Putamurdie -1	-	?2076	?2303	3194	3364	3925
Roseneath -1		BASIN	MARGIN	SEQUENCE		
Spencer 1-2		BASIN	MARGIN	SEQUENCE		
Strzelecki 1-10		BASIN	MARGIN	SEQUENCE		
Tallalia -1	-	2208	2499	3141	3152	4530
Tanbar -1	-	(N.S.)	?3740	4568	4691	5598
Tartulla -1	-	2350	2796	3567	3678	4846
Tickalara -1		BASIN	MARGIN	SEQUENCE		
Tilparee -A1		BASIN	MARGIN	SEQUENCE		
Tindilpie -1		OVERLAPPING	SEQUENCE			
Tinga Tingana -1		BASIN	MARGIN	SEQUENCE		
Tirrawarra -1	-	3025	3353	4054	4070	5366
-2	-	(N.S.)	3410	4063	4092	5391
-3	-	(N.S.)	3569	4239	4288	5569
-4		NO LOGS	ABOVE	'C'	HORIZON	

WELL NAME	WINTON FM	MACKUNDA FM	ALLARU MUDSTONE	TOOLEBUC FM	WALLUMBILLA FM	'C'
Tirrawarra -5	-	(N.S.)	3453	4180	4222	5470
-6	-	(N.S.)	3374	4082	4118	5465
-7	-	(N.S.)	3560	4254	4273	5510
-8	-	(N.S.)	3386	4075	4112	5404
-9	-	(N.S.)	3386	4050	4092	5455
-10		(N.S.)	3466	4157	4195	5509
-11	-	(N.S.)	3464	4165	4188	5401
-12	-	3118	3480	4174	4223	5496
-13	-	3168	3448	4112	4136	5454
-14	-	3008	3323	4043	4058	5358
-15	-	3060	3384	4038	4064	5378
-16	-	3160	3496	4187	4245	5486
-17	-	3035	3359	4046	4072	5434
-18	-	3132	3452	4132	4170	5456
Toolachee 1-9		BASIN	MARGIN	SEQUENCE		
Toolachee East -1		BASIN	MARGIN	SEQUENCE		
Topwee -1		BASIN	MARGIN	SEQUENCE		
Wackett -1	-	1876	2246	2960	3042	4116
Walkandi -1	-	?	?	4599	4752	5540
Wanara -1		BASIN	MARGIN	SEQUENCE		
Wanchoocha -1		BASIN	MARGIN	SEQUENCE		
Wantana -1	-	3043	3160	3896	3939	5321
Wareena -1	-	551	826	1685	1815	2906
Weedina -1		BASIN	MARGIN	SEQUENCE		
Weena -1		BASIN	MARGIN	SEQUENCE		
Welcome Lake -1	-	3060	3400	4148	4193	5395
Wills -1		BASIN	MARGIN	SEQUENCE		
Wilpinnie -1		BASIN	MARGIN	SEQUENCE		
Wimma -1	-	3799	4147	4890	4938	6354
Wirrarie -1		BASIN	MARGIN	SEQUENCE		
Witcherrie -1	-	?	?	735	762	920
Wolgolla -1		BASIN	MARGIN	SEQUENCE		
Wooloo -1		BASIN	MARGIN	SEQUENCE		
Yalcumma -1		BASIN	MARGIN	SEQUENCE		
Yanko -1		OVERLAPPING	SEQUENCE			
Yanpurra -1	-	3011	3253	3968	4000	5342
Yapeni -1		BASIN	MARGIN	SEQUENCE		
Yongala -1	-	2224	2692	3436	3506	4278

FORMATION TOPS (cont.)

As at June, 1982

2B. BASIN MARGIN SEQUENCE (DEPTH K.B.)

WELL NAME	WINTON FM	MACKUNDA FM	OODNADATTA FM	COORIKIANA SST	BULLDOG SHALE	'C'
Adria Downs -1		BASINAL		SEQUENCE		
Alkina -1		BASINAL		SEQUENCE		
Arrabury -1		BASINAL		SEQUENCE		
Ashby -1	-	1934	2272	3202	3221	4198
Barrolka -1		BASINAL		SEQUENCE		
Barrolka East -1		BASINAL		SEQUENCE		
Beanbush -1		BASINAL		SEQUENCE		
Belah -1	-	2054	2338	3218	3244	4111
Betoota -1		BASINAL		SEQUENCE		
Big Lake -1	-	3050	3317	4229	4253	5352
-2	-	3053	3258	4142	4177	5238
-3	-	N.S.	3390	4315	4346	5375
-4	-	N.S.	3322	4292	4332	5322
-5	-	N.S.	3295	4180	4202	5286
-6	-	N.S.	3284	4226	4260	5325
-7	-	N.S.	3436	4290	4335	5354
-8	-	N.S.	3372	4187	4217	5287
-9	-	N.S.	3180	4110	4144	5252
-10	-	N.S.	3327	4292	4313	5334
-11	-	N.S.	3244 = TOP	MARREE	SUBGROUP	5286
-12	-	N.S.	3276	4211	4243	5260
-13	-	N.S.	3436	4418	4462	5386
-14	-	N.S.	3430	4380	4426	5330
-15	-	N.S.	3303	4254	4285	5281
-16	-	N.S.	3233	4164	4195	5275
-17	-	N.S.	3310	4273	4303	5302
-18	-	N.S.	3148	4134	4153	5264
-19A	-	N.S.	3290	4256	4285	5291
-20	-	N.S.	3285	4212	4239	5298
-21	-	N.S.	3363	4260	4296	5352
-22	-	N.S.	3339	4344	4386	5326
-23	-	N.S.	3657	4445	4498	5357
-24	-	N.S.	3375	4301	4353	5373

WELL NAME	WINTON FM	MACKUNDA FM	OODNADATTA FM	COORIKIANA SST	BULLDOG SHALE	'C'
Big Lake -25	-	N.S.	3377	4283	4326	5338
-26	-	2935	3205	4166	4199	5270
-27	-	3017	3255	4251	4238	5287
Boorthanna -1	-	-	-	-	-	12
Boxwood -1	-	2263	2438	3335	3366	4133
Brolga -1		BASINAL		SEQUENCE		
Brumby -1	-	2206	2507	3346	3363	4272
Burke -1	-	2460	2727	3721	3759	4718
-2	-	2474	2817	3725	3758	4751
-3	-	2498	2802	3738	3764	4752
-4	-	2519	2814	3750	3762	4708
Burley -1		BASINAL		SEQUENCE		
Cherri -1	-	1510	1903	2509	2512	3082
Coochilara -1	-	2426	2780	3738	3789	4655
Coonatie 1-2		BASINAL		SEQUENCE		
Coongie -1		BASINAL		SEQUENCE		
Coopers Ck -1		BASINAL		SEQUENCE		
Cootanoorina -1	-	-	-	-	7	370
Corkwood -1	-	1960	2188	3244	3263	4158
Curalle -1		BASINAL		SEQUENCE		
Cutapirrie -1		BASINAL		SEQUENCE		
Daralingie -1	-	2686	2898	3762	3798	4651
-2	-	2637	2828	3786	3806	4745
-3	-	N.S.	3091	4031	4055	4792
-4	-	2764	2935	3995	4024	4810
Della -1	-	2110	2553	3361	3381	4325
-2	-	2263	2618	3553	3595	4486
-3	-	2100	2412	3389	3411	4363
-4	-	2152	2413	3255	3287	4255
-5A	-	N.S.	2335	3281	3321	4246
-6	-	2177	2506	3393	3438	4390
-7	-	2118	2455	3393	3432	4336
-8	-	2008	2398	3188	3217	4260
-9	-	2168	2507	3303	3343	4369
-10	-	2100	2375	3303	3344	4282
-11	-	2147	2388	3278	3305	4250
-12	-	2126	2510	3323	3347	4296
-13	-	2124	2381	3297	3327	4336

WELL NAME	WINTON FM	MACKUNDA FM	OODNADATTA FM	COORIKIANA SST	BULLDOG SHALE	'C'
Della -14	-	2323	2572	3413	3452	4322
-15	-	2122	2381	3296	3320	4272
-16	-	2148	2421	3304	3339	4320
-17	-					
Dilchee -1	-	2524	?2785	3737	3774	4741
-2						
Dilchee West -1						
Dullingari -1	-	2227	2549	3518	3553	4492
-2	-	2296	2613	3634	3667	4536
-3	-	N.S.	2631	3613	3636	4634
-4	-	N.S.	2657	3652	3686	4603
-5	-	2312	2546	3542	3572	4552
-6	-	2409	2633	3673	3709	4590
-7	-	2392	2608	3680	3714	4574
-8	-	2258	2528	3483	3521	4575
-9	-	2263	2565	3610	3631	4562
-10	-	2320	2614	3570	3598	4645
-11	-	2389	2689	3684	3712	4688
-12	-	2344	2665	3668	3708	4646
-13	-	2297	2629	3624	3641	4580
-14	-	2280	2598	3671	3699	4570
-15	-	2253	2570	3584	3603	4550
-16	-	2178	2629	3464	3499	4503
-17	-	2376	2745	3607	3645	4640
-18	-	2305	2574	3585	3619	4540
-19	-	2324	2650	3643	3675	4542
-20	?432	2202	2467	3598	3624	4576
-21						
-22						
-23	-	2248	2593	3572	3617	4524
-24	-	2317	2628	3644	3680	4584
-25	-	2276	2602	3540	3574	4534
-26						
-27	-	2300	2608	3596	3630	4600
-28	-	2220	2494	3525	3556	4554
Dullingari North -1	-	2320	2618	3544	3563	4565
-2	-	2394	2684	3604	3621	4556
-3						

WELL NAME	WINTON FM	MACKUNDA FM	OODNADATTA FM	COORIKIANA SST	BULLDOG SHALE	'C'
Durham Downs -1	-	BASINAL		SEQUENCE		
Epsilon -1		1885	2234	3148	3189	
-2	-	2020	2316	3220	3260	4254
Erabena -1		BASINAL		SEQUENCE		
Fly Lake 1-6		BASINAL		SEQUENCE		
Galway -1	-	BASINAL		SEQUENCE		
Gidgealpa 1-15		BASINAL		SEQUENCE		
-16	-	2708	2990	3883	3900	4723
-17	-	BASINAL		SEQUENCE		
Gilpeppee 1-2		BASINAL		SEQUENCE		
Gurra -1	-	1636	2015	2614	2618	3158
Hume -1	-	2197		3440	3481	4390
Ingella -1		BASINAL		SEQUENCE		
Innamincka 1-3		BASINAL		SEQUENCE		
Jack Lake -1		OVERLAPPING		SEQUENCE		
Jackson -1		BASINAL		SEQUENCE		
-2	-	1117	1534	= TOP MARREE	SUBGROUP	3384
-3	-	1154	1556	= TOP MARREE	SUBGROUP	3368
Jackson South -1	-	1165	1397	= TOP MARREE	SUBGROUP	3283
-2	-	1152	1470	= TOP MARREE	SUBGROUP	3281
Kalladeina -1		BASINAL		SEQUENCE		
Kanowana -1		BASINAL		SEQUENCE		
Karmona -1		BASINAL		SEQUENCE		
Kerna -1	-	2454	2752	3652	3664	4729
-2A	-	2560	2835	3793	3815	4818
Kidman -1	-	2090	2405	3304	3339	4342
-2	-	2422	2696	3507	3545	4516
Kirby -1		BASINAL		SEQUENCE		
Kudrieke -1		BASINAL		SEQUENCE		
Kumbarie -1	-	1853	2233	2838	2846	3512
Kuncherinna -1		BASINAL		SEQUENCE		
Lake Frome -1	-	-	-	-	-	?394
-2	-	-	-	-	-	?410
-3	-	-	-	-	-	-
Lake Hope -1		OVERLAPPING		SEQUENCE		
Macumba -1		BASINAL		SEQUENCE		
Marabooka -1	-	2228	2538	3404	3450	4354
-2	-	2212	2508	3438	3491	4401

WELL NAME	WINTON FM	MACKUNDA FM	OODNADATTA FM	COORIKIANA SST	BULLDOG SHALE	'C'
McKinlay -1	-	2013	2191	2969	3018	3731
-2	-	2040	2250	2955	2992	3730
Merrimelia 1-9		BASINAL		SEQUENCE		
Mitchie -1		BASINAL		SEQUENCE		
Mokari -1		BASINAL		SEQUENCE		
Moomba -1	-	3009	3352	4255	4285	5306
-2	-	2880	3147	4124	4146	5258
-3	-	3156	3479	4449	4474	5450
-4	NO	LOGS ABOVE	'C'	HORIZON		5445
-5	-	N.S.	3403		4338	5469
-6	NO	LOGS ABOVE	'C'	HORIZON		5498
-7	-	3056	3284	4288	4313	5395
-8	-	3128	3383	4294	4324	5346
-9	-	N.S.	3362	4355	4372	5427
-10	-	3004	3303	4296	4317	5345
-11	-	3060	3363	4467	4491	5444
-12	-	N.S.	3444	4337	4385	5404
-13	-	N.S.	3377	4383	4404	5453
-14	-	N.S.	3222	4144	4215	5312
-15	NO	LOGS ABOVE	'C'	HORIZON		5424
-16	NO	LOGS ABOVE	'C'	HORIZON		5353
-17	NO	LOGS ABOVE	'C'	HORIZON		5388
-18	-	N.S.	3288	4331	4361	5405
-19	-	N.S.	3393	4360	4398	5417
-20	-	N.S.	3313	4268	4294	5337
-21	-	N.S.	3354	4338	4378	5426
-22	-	N.S.	3361	4320	4344	5387
-23	-	N.S.	3395	4372	4413	5477
-24	-	N.S.	3299	4301	4338	5348
-25	-	N.S.	3297	4222	4261	5332
-26	-	3160	3437	4421	4462	5458
-27	-	N.S.	3524	4456	4496	5552
-28	-	N.S.	3289	4251	4287	5355
-29	-	N.S.	3283	4278	4321	5322
-30	-	N.S.	3209	4202	4236	5389
-31	-	N.S.	3346	4324	4359	5406
-32	-	N.S.	3282	4297	4330	5383
-33	-	N.S.	3397	4335	4373	5380
-34	-	N.S.	3335	4464	4488	5386

WELL NAME	WINTON FM	MACKUNDA FM	OODNADATTA FM	COORIKIANA SST	BULLDOG SHALE	'C'
Moomba -35	-	N.S.	3317	4319	4345	5357
-36	-	N.S.	3203	4203	4233	5318
-37	-	N.S.	3267	4246	4279	5362
-38	-	N.S.	3343	4334	4356	5359
-39	-	N.S.	3376	4290	4317	5339
-40	-	N.S.	3446	4278	4303	5378
-41	-	N.S.	3249	4252	4292	5334
-42	-	N.S.	3252	4196	4213	5278
-43	-	N.S.	3317	4243	4264	5294
-44	-	N.S.	3315	4303	4325	5390
-45	-	3078	3367	4290	4320	5412
-46	-	2998	3290	4260	4296	5359
Moorari 1-4		BASINAL		SEQUENCE		
Morney -1		BASINAL		SEQUENCE		
Mt. Crispe -1		BASINAL		SEQUENCE		
Mt. Howitt -1		BASINAL		SEQUENCE		
Mudera -1	-	2312	2605	3488	3536	4548
Mudlalee -1	-	2114	2490	3175	3189	4130
-2	-	2054	2396	3096	3117	4000
Mudrangie 1-2		BASINAL		SEQUENCE		
Mulga -1	-	2150	2455	3259	3274	3980
Munkarie -1	-	2232	2520	3431	3440	4236
-2	-	2116	2413	3304	3310	4222
Murteree -1	-	2190	2478	3344	3376	4197
-A1	-	1868	2244	2973	3001	3694
-C1	-	2380	2718	3572	3586	4312
Naccowlah -1		BASINAL		SEQUENCE		
Namur -1	-	2870	3185	4077	4111	5090
-2	-	3024	3264	4069	4102	5010
Nappacoongie -1	-	1907	2184	3102	3122	4069
-2	-	1906	2155	3084	3102	4006
Narcoonowie -1	-	2146	2480	3270	3290	4128
Naryilco -1		1159	1456	2173	2185	3223
Orientos -1		N.S.	?2081	2984	3018	4087
Orientos North -1		1907	2200	3114	3154	4085
Padcksaddle 1-3		BASINAL		SEQUENCE		
Pandieburra -1		BASINAL		SEQUENCE		
Pando -1	-	2227	2398	3283	3315	4048

WELL NAME	WINTON FM	MACKUNDA FM	OODNADATTA FM	COORIKIANA SST	BULLDOG SHALE	'C'
Pando -2	-	2304	2463	3296	3324	4137
Pando North -1	-	2396	2614	3523	3540	4293
Paning -1	-	BASINAL		SEQUENCE		
Pelketa -1	-	2302	2616	3439	3465	4296
Pinna -1	-	2386	2585	3553	3579	4370
Poolowanna -1		BASINAL		SEQUENCE		
Poonorunna -1		BASINAL		SEQUENCE		
Purni -1		BASINAL		SEQUENCE		
Putamurdie -1		BASINAL		SEQUENCE		
Roseneath -1	-	1846	2145	3076	3106	4126
Spencer -1		NO LOGS	ABOVE 4200	FEET		4350
-2	-	2246	2527	3355	3396	4112
Strzelecki -1	-					
-2	-	2238	2694	3402	3438	4315
-3	-	2124	2608	3311	3348	4218
-4	-	2270	2621	3270	3318	4241
-5	-	2130	2586	3286	3331	4234
-6	-	2084	2523	3261	3310	4212
-7	?356	2186	2507	3327	3378	4260
-8	-	2155	2505	3250	3293	4224
-9	392	2160	2502	3321	3371	4221
-10						
Tallalia -1		BASINAL		SEQUENCE		
Tanbar -1		BASINAL		SEQUENCE		
Tartulla -1		BASINAL		SEQUENCE		
Tickalara -1	-	1734	1985	2735	2747	3730
Tilparee -A1	-	2304	2564	3367	3405	4178
Tindilpie -1		OVERLAPPING		SEQUENCE		
Tinga Tingana	-	1945	2200	2822	2827	3494
Tirrawarra 1-18		BASINAL		SEQUENCE		
Toolachee -1	-	2216	2492	3314	3331	4219
-2	-	2123	2446	3271	3283	4241
-3	-	2400	2662	3453	3463	4324
-4	-	N.S.	2664	= TOP MARREE	SUBGROUP	4338
-5	-	2360	2744	3580	3595	4379
-6	-	2250	2623	3447	3461	4366
-7	-	2408	2732	3513	3524	4375

WELL NAME	WINTON FM	MACKUNDA FM	OODNADATTA FM	COORIKIANA SST	BULLDOG SHALE	'C'
Toolachee -8	-	2322	2607	3424	3436	4324
-9	-	2322	2664	3495	3504	4333
Toolachee East -1	-	2400	2792	3569	3576	4440
Topwee -1	-	2790	3072	3843	3880	4797
Wackett -1		BASINAL		SEQUENCE		
Walkandi -1		BASINAL		SEQUENCE		
Wanara -1	-	2111	2419	3389	3426	4313
Wancoocha -1	-	2280	2490	3360	3398	4230
Wantana -1		BASINAL		SEQUENCE		
Wareena -1		BASINAL		SEQUENCE		
Weedina -1	-	-	-	-	-	12
Weena -1	-	1805	2175	= TOP MARREE	SUBGROUP	3272
Welcome Lake -1		BASINAL		SEQUENCE		
Wills -1	-	1806	2103	3000	3030	3843
Wilpinnie -1	-	2184	2450	3363	3384	4392
Wimma -1		BASINAL		SEQUENCE		
Wirrarie -1	-	2600	2858	3653	3693	4548
Witcherrie -1		BASINAL		SEQUENCE		
Wolgolla -1	-	N.S.	2193	3072	3101	4003
Wooloo -1	-	2904	3162	3982	4020	4904
Yalcumma -1	-	3088	3380	4345	4383	5247
Yanko -1		OVERLAPPING		SEQUENCE		
Yanpurra -1		BASINAL		SEQUENCE		
Yapeni -1	-	2717	2822	3803	3814	4646
Yongola -1		BASINAL		SEQUENCE		

FORMATION TOPS

As at June, 1982

2C OVERLAPPING SEQUENCE (DEPTH K.B., FEET)

WELL NAME	WINTON FM	MACKUNDA FM	ALLARU MUDSTONE	TOOLEBUC FM	OODNADATTA FM	COORIKIANA SST	BULLDOG SHALE	'C'
Jack Lake -1	-	3332	3562	4189	4264	4552	4560	5460
Lake Hope -1	-	2694	2955	3536	3573	3846	3876	4667
Tindilpie -1	-	3502	3763	4314	4370	4672	4692	5615
Yanko -1	-	1980	2273	2900	2954	3140	3170	4222

2D TRANSITIONAL SEQUENCES (Where neither the Toolebuc Formation nor the Coorikiana Sandstone are developed)

WELL NAME	WINTON FM	MACKUNDA FM	MARREE SUBGROUP	'C'
Jackson -2	-	1117	1534	3384
-3	-	1154	1556	3368
Jackson South -1	-	1165	1397	3283
-2	-	1152	1470	3281
Merrimelia -1	-	3010	3250	5157
-2	-	3030	3280	5172
-4	-	2805	3196	5087
-6	-	2745	3054	4833
Weena -1	-	1805	2175	3272

LEGEND
WELL LOCATION
OIL
GAS
OIL SHOW
GAS SHOW
ABANDONED
W WATER
WI WATER INJECTION
GI GAS INJECTION
ST STRATIGRAPHIC TEST
REVISION
N° Date Authority Comment
N.T.
QLD.
W.A.
S.A.
N.S.W.
VIC.
TAS.
KILOMETRES
0 400 800
LOCATION MAP
NORTHERN TERRITORY
QUEENSLAND
SOUTH AUSTRALIA
NEW SOUTH WALES
A.T.P. 259P
P.E.L. 5&6
A
B
C
D
E
F
G
H
J
K
L
N
DELHI PETROLEUM PTY. LTD.
P.E.L. 5&6 S.A., A.T.P. 259P QLD.
LOCATION
OF CROSS-SECTIONS
8621-4
SCALE 1:1000000
KILOMETRES
MILES
POLYCONIC PROJECTION
Contour Interval : N.A.
Datum : N.A.
Chief Geologist :
Author : P.S. MOORE
Drafted, J.B.
Date, AUG./82
Chief Draftsman
Date OCT 1982
Drawing Number
82XG-1332
Enclosure 1
DELHI
File 10-42

8621-S

DELHI PETROLEUM PTY. LTD.

CRETACEOUS STRATIGRAPHY OF THE EROMANGA BASIN - CROSS SECTION A-B

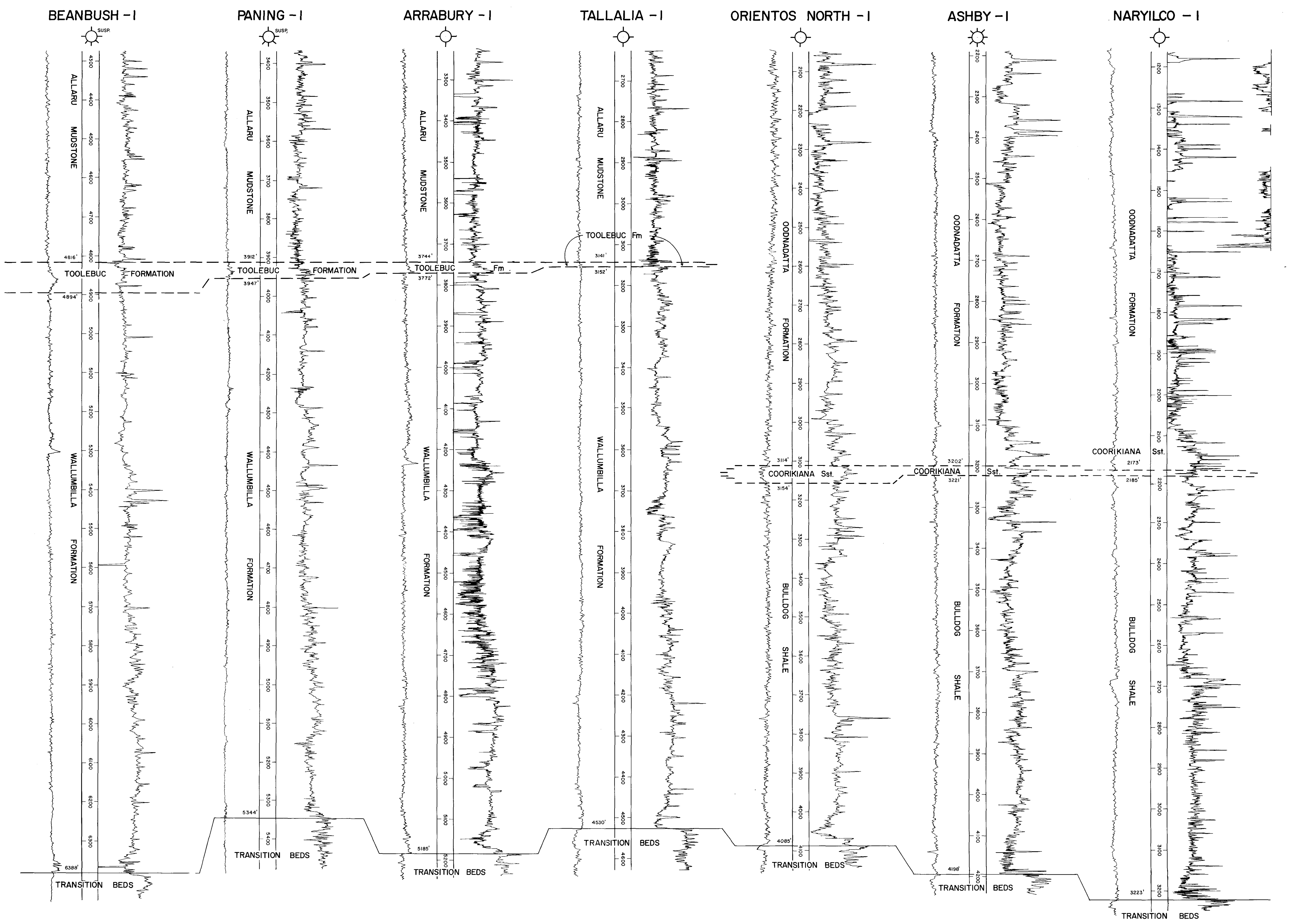
SCALE ONE INCH EQUALS ONE HUNDRED FEET	DATE SEPT. 1981	Drawing No. 81XG-0747	File RP-41

8621-6

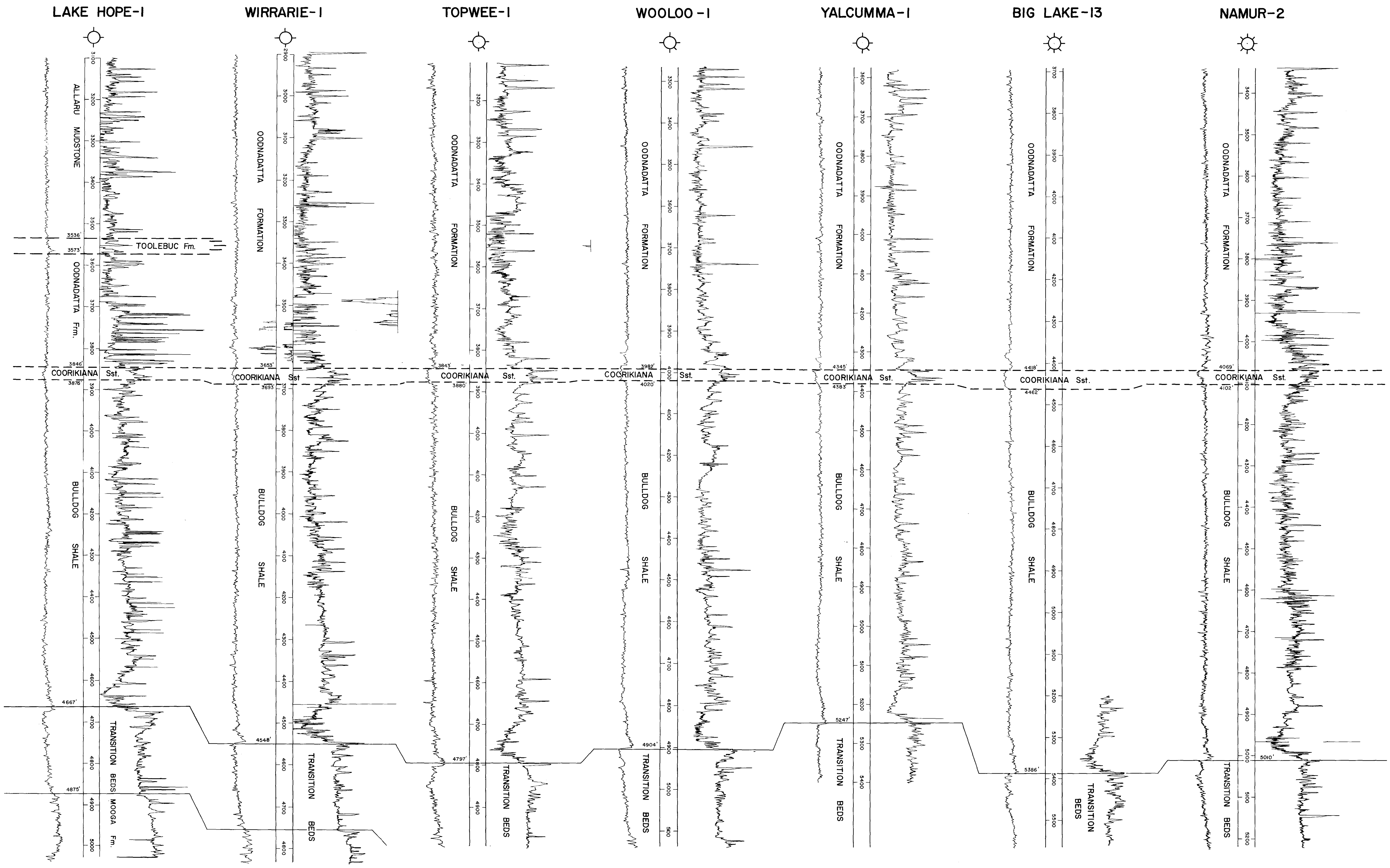
DELHI PETROLEUM PTY. LTD.

CRETACEOUS STRATIGRAPHY OF THE EROMANGA BASIN - CROSS SECTION C-D

SCALE ONE INCH EQUALS ONE HUNDRED FEET	DATE SEPT. 1981	Drawing No. 81 XG-0746	File RP-41



DELHI PETROLEUM PTY. LTD.	8621-7		
CRETACEOUS STRATIGRAPHY OF THE EROMANGA BASIN - CROSS SECTION E-F			
SCALE. ONE INCH EQUALS ONE HUNDRED FEET.	DATE SEPT. 1981	Drawing No. 81XG-0744	File. RP-41



8621-8

DELHI PETROLEUM PTY. LTD.

CRETACEOUS STRATIGRAPHY OF THE EROMANGA BASIN - CROSS SECTION C-H

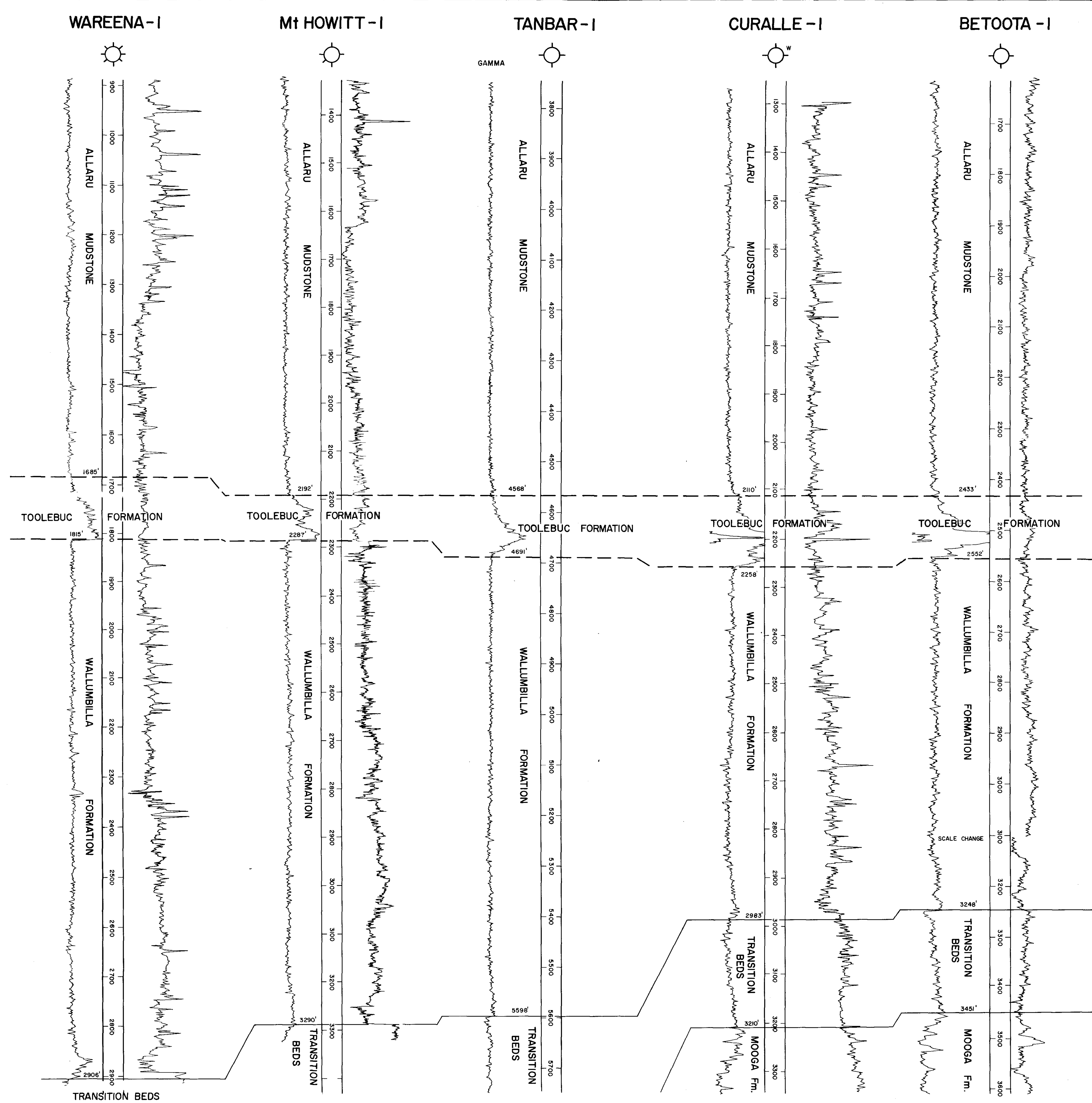
SCALE. ONE INCH EQUALS ONE HUNDRED FEET	DATE SEPT. 1981	Drawing No. 81XG-0745	File. RP-41

8621-9

DELHI PETROLEUM PTY. LTD.

CRETACEOUS STRATIGRAPHY OF THE EROMANGA BASIN - CROSS SECTION G-J

SCALE: ONE INCH EQUALS ONE HUNDRED FEET	DATE SEPT. 1981	Drawing No. 81XG-0747	File. RP-41



8621-10

DELHI PETROLEUM PTY. LTD.

CRETACEOUS STRATIGRAPHY OF THE EROMANGA BASIN - CROSS SECTION L-K

SCALE. ONE INCH EQUALS ONE HUNDRED FEET	DATE. SEPT. 1981	Drawing No. 81XG-0742	File. RP-41

DELHI PETROLEUM PTY. LTD.

CRETACEOUS STRATIGRAPHY OF THE

[illegible]

8621-11

SCALE. ONE INCH EQUALS ONE HUNDRED FEET	DATE. SEPT. 1981	Drawing No: 81XG — 0743	File: RP—41