DEPARTMENT OF
MINES AND ENERGY
SOUTH AUSTRALIA

STRATIGRAPHY, PALAEONTOLOGY, MALACOLOGY

Papers in honour of Dr Nell Ludbrook

Department of Mines and Energy
South Australia

STRATIGRAPHY, PALAEONTOLOGY, MALACOLOGY

PAPERS IN HONOUR OF DR NELL LUDBROOK

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Cretaceous subsurface stratigraphy of the southwestern Eromanga Basin: a review

P.S. MOORE and G.M. PITT

MOORE, P.S. and PITT, G.M., 1985:06:14. Cretaceous subsurface stratigraphy of the southwestern Eromanga Basin: a review. *Spec. Publ., S. Aust. Dept Mines and Energy*, 5: 269-286. ISBN 0 7243 7411 6.

The petroleum licence areas PELs 5 and 6 in South Australia and ATP 259P in Queensland extend over the southwestern one-third of the Eromanga Basin, and include nearly 500 petroleum wells. Information from these wells has been combined with outcrop and other data to provide a comprehensive synthesis of the Cretaceous stratigraphy of this very large area. Nine Cretaceous formations are discussed in detail, from the Cadna-owie Formation up to the Winton Formation. The lateral continuity of the various facies is quite remarkable, and indicates deposition in and adjacent to an epeiric sea.

P.S. Moore, Delhi Petroleum Pty Ltd, 33 King William Street, Adelaide, South Australia, 5000; G.M. Pitt, Western Mining Corporation Ltd, 168 Greenhill Road, Parkside, South Australia, 5063; *received 17 February 1983.*

The Cretaceous subsurface stratigraphy of the southwestern Eromanga Basin was recently revised by Moore and Pitt (1982a,b) and Moore *et al.* (in press). This paper presents additional new information on the Cretaceous geology of PELs 5 and 6 in South Australia and ATP 259P in southwestern Queensland as well as summarising existing results. The area occupies approximately 394 000 km², and contains nearly 500 petroleum wells, most of which were used to provide data for this report (Fig. 1). The hydrocarbon potential of the sequence has been discussed elsewhere (Moore, 1983; Moore and Pitt, 1984) and will not be repeated here.

Stratigraphic Framework

A stratigraphic framework for the subsurface Cretaceous of the southwestern Eromanga Basin is summarised in Figure 2. The Winton and Mackunda Formations are recognised over the entire area, and overlie a finer grained sequence dominated by shallow-marine mudstones. These in turn overlie the sandy and silty Cadna-owie Formation (otherwise known informally as the 'Transition Beds'). The Cadna-owie Formation rests with apparent conformity on either Algebuckina Sandstone or sediments of the Mooga Formation, which are Jurassic to earliest Cretaceous in age.

The marine mudstone sequence contains the dark, organic-rich Toolebuc Formation over most of the study area, and is thus subdivided into Wallumbilla Formation, Toolebuc Formation, and Allaru Mudstone. However, around the margins of the Eromanga Basin, the Toolebuc Formation is absent due to facies changes. Instead, the sequence is interrupted by the glauconitic Coorikiana Sandstone. In this case, it is subdivided into Bulldog Shale, Coorikiana Sandstone and Oodnadatta Formation (Fig. 2).

Although the Toolebuc Formation and Coorikiana Sandstone are generally mutually exclusive, there are a few areas where these two units overlap. In this case (*e.g.* Lake Hope 1, Tindilpie 1 and parts of Gidgealpa), the stratigraphic nomenclature also overlaps (Lake Hope 1 and Tindilpie 1 logs, Figs 4 and 5). Rarely, both the Toolebuc Formation and Coorikiana Sandstone are absent. This situation was first recognised in the basin-margin Marree area by Forbes *et al.* (1965), but also occurs in the subsurface further to the east and in the Abminga area, northwest of Oodnadatta. In these circumstances, the sequence from the base of Mackunda Formation to the top of Cadna-owie Formation is simply referred to as the Marree Subgroup (Fig. 2).

Details of how this stratigraphic scheme evolved are presented by Moore and Pitt (1982b) and Moore *et al.* (in press) and will not be discussed here. The stratigraphic nomenclature has been successfully applied to all petroleum wells drilled in PELs 5 and 6 and ATP 259P, and has been accepted by all 24 petroleum companies with a working interest in the area (Moore and Pitt, 1984).

Representative gamma-ray log correlations for the lower part of the section are shown in Figures 3-5. Detailed electric-log analysis has shown that there are three major gamma-ray marker horizons within the sequence:

a) the maximum gamma-ray spike within Toolebuc Formation (T2: Figs 3 and 4),
b) the top of Coorikiana Sandstone (K2: Fig. 5),
c) the top of Cadna-owie Formation (C: Figs 3-5).

Log correlations are generally quite simple, due to the distinctive lithologies and log responses of the Toolebuc Formation and Coorikiana Sandstone. Furthermore, both of these formations produce strong seismic reflections which have been mapped and tied in with well control over most of the study area. Palynological results, where available, support the rest of the data.

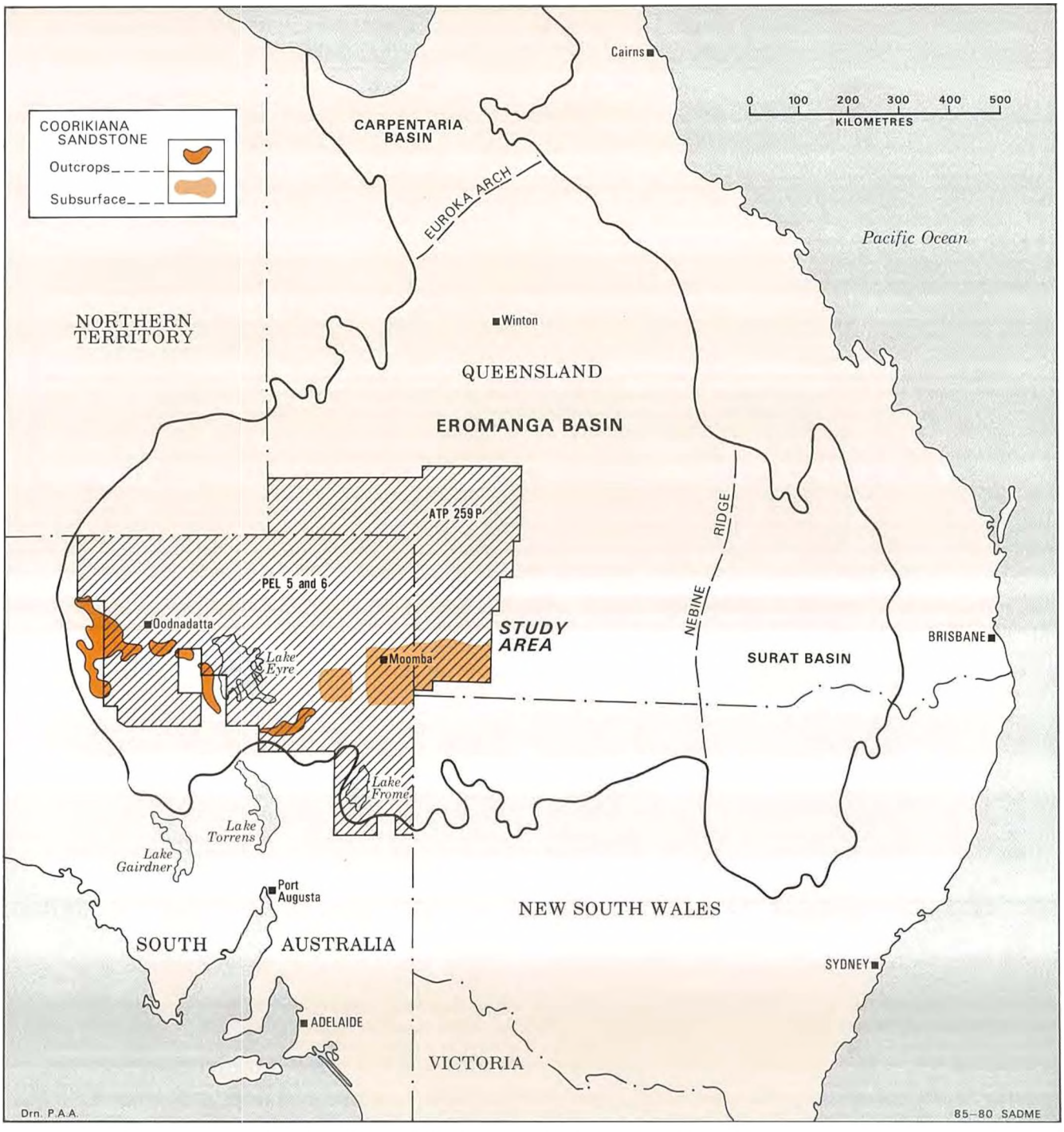

Figure 1. Location map, with study area hatched.

The Base of the Cretaceous

In the subsurface of PELs 5 and 6 and ATP 259P, the Jurassic-Cretaceous boundary lies within the upper part of the Algebuckina Sandstone and laterally equivalent Mooga Formation (Fig. 2). The exact position of the boundary is poorly defined, due to the sandy nature of the sequence, the scarcity of dinoflagellates and the broad time range of the *Cicatricosisporites australiensis* spore-pollen Subzone.

It is beyond the scope of this paper to discuss the stratigraphy of the Algebuckina Sandstone and Mooga Formation. Descriptions of Algebuckina Sandstone in outcrop and subsurface are provided by Wopfner *et al.* (1970) and Moore (in press), while the stratigraphy of the Mooga Formation is summarised by Nugent (1969), Wopfner (1969) and Bowering (1982). The Murta Member of Mooga Formation is a basal Cretaceous lacustrine unit, and has been described in considerable detail by Mount (1981, 1982) and Ambrose *et al.* (1982).

In outcrop around the western margins of the Eromanga Basin, the Jurassic-Cretaceous boundary is thought to approximate the top of the Algebuckina Sandstone (Wopfner *et al.*, 1970; Harris, 1970). In some outcrops it has been observed that the contact with overlying Cadna-owie Formation is a silcreted, leached unconformity surface (Ambrose, 1980; Ambrose and Flint, 1982) which may indicate a significant time break between the units. This would account for the younger (Cretaceous) ages obtained from the top of the Algebuckina Sandstone and its lateral equivalents in the subsurface, where they are overlain conformably by the Cadna-owie Formation.

Stratigraphy and Depositional Environments of the Cadna-owie Formation

Definition

The name Cadna-owie Formation was first used on the OODNADATTA 1:250 000 geological map (Freytag *et al.*, 1967). The formation was described in detail by Wopfner *et al.* (1970), who designated a type section 4 km west-southwest of the disused Algebuckina Rail Siding in northern South Australia. Lithology in outcrop is typically fine to medium-grained sandstone with a calcareous matrix. Interbeds of siltstone are common, and there are also a few horizons of carbonaceous material, calcareous sandy oolites and boulder beds (Wopfner *et al.*, 1970; Forbes, 1982). In outcrop the formation rests, in some areas unconformably, on Algebuckina Sandstone and is overlain sharply, but in most cases probably conformably, by Bulldog Shale. The possibility of a local unconformity at the top of the Cadna-owie Formation in southwestern Queensland has been noted by Moore and Pitt (1984). Reflection seismic data suggest the presence of channels, up to 100 m deep, incised into Cadna-owie Formation and underlying units in the Wareena area (Figs 9 and 10) and east thereof. Supporting evidence for an unconformity is the local absence of the *Cyclosporites hughesi* spore-pollen Subzone, and a sharp increase in vitrinite reflectance values in some wells. However more data are needed before the nature of this erosional contact is fully understood.

The Cadna-owie Formation extends into the subsurface and reaches a maximum measured thickness of 92 m at Kirby 1 (Fig. 9). In the southern Cooper Basin area, Algebuckina Sandstone is not recognised, and Cadna-owie Formation (informally known as 'Transition Beds') rests conformably on Mooga Formation (Fig. 2). The Cadna-owie Formation has been described in the subsurface as far east as central Queensland, where it lies conformably between the Hooray Sandstone and the Wallumbilla Formation (Senior *et al.*, 1978).

Sandy members in the upper part of the formation are known as the Mount Anna Sandstone Member (Wopfner *et al.*, 1970) in central South Australia, and the Wyandra Sandstone Member (Senior *et al.*, 1975) in Queensland.

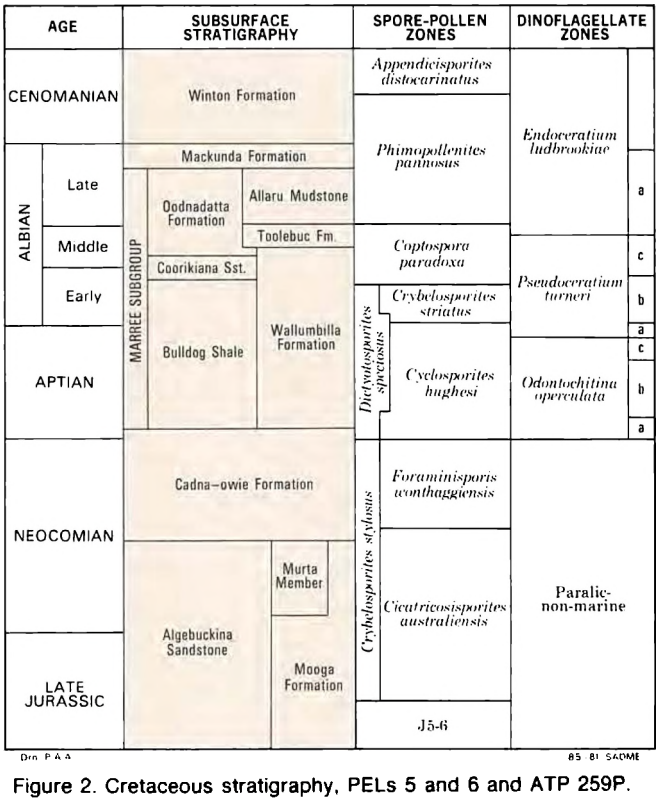

Figure 2. Cretaceous stratigraphy, PELs 5 and 6 and ATP 259P.

Age and palaeontology

General: A spore-pollen assemblage from the middle portion of the Cadna-owie Formation was described by Harris (1965) and recorded by Wopfner *et al.* (1970). The formation belongs either to the upper half of the *Foraminisporis wonthaggiensis* Subzone, or to the *C. hughesi* Subzone (Fig. 2). Ludbrook (1965) determined plant fragments and megaspores from the same part of the type section and a fish tooth from the lower part. Foraminifera have also been described from the formation by Ludbrook (1966) and Scheibnerová (1980). Wopfner *et al.* (1970) assigned a Neocomian to early Aptian age to the sequence.

Several boulder-bearing beds were noted in the Cadna-owie Formation by Wopfner *et al.* (1970). Campbell *et al.* (1977) reported that a minor percentage of Cadna-owie boulders in the Dalhousie and Andamooka areas contain Early Devonian brachiopod, bivalve, tentaculite and crinoid remains. They interpreted these boulders as reworked glacial erratics derived from erosion of Permian sediments.

Subsurface Data From PELs 5 and 6 and ATP 259P: Palynological data from the study area (Moore *et al.*, in press) suggest that the Neocomian-Aptian boundary approximates the top of the Cadna-owie Formation, with the uppermost part of the formation being possibly earliest Aptian in age (Fig. 2). Similar results are quoted by Senior *et al.* (1978) from central Queensland. Despite the formation generally being described as marine in origin, the first positive indications of a marine fauna are associated with the *F. wonthaggiensis* Subzone, in the middle part of the formation (Ambrose *et al.*, 1982). As well as spores and pollen, dinoflagellates and acritarchs are described from the upper part of the sequence.

Distribution, lateral variation, and environment of deposition

Despite the complex stratigraphic nomenclature applied to the sequence enclosing the Cadna-owie Formation, the unit is very uniform in character throughout the study area and beyond. Typical thicknesses in the Cooper Basin region are 75-100 m.

The formation coarsens upwards, from grey siltstone at the base into fine to occasionally medium-grained calcareous sandstone at the top. The uppermost, porous and permeable sandy unit is an important aquifer, and has been called the Wyandra Sandstone Member in central Queensland (Senior *et al.*, 1978). This unit can be correlated through most of the study area. The top of the Cadna-owie Formation corresponds with the 'C' horizon, the most distinctive and persistent seismic reflector in the Eromanga Basin.

According to Wopfner (1969), the various lithologies in outcropping Cadna-owie Formation can be attributed to specific marginal-marine environments such as backwater lagoons, sand bars, deltaic conditions and shallow agitated waters. Non-marine environments are represented by the Mount Anna Sandstone Member, a pebbly fluviatile and deltaic sandstone which crops out to the southwest of the study area.

The coarsening-upwards nature of the unit in the subsurface might suggest a regressive marine event, but this is not supported by palaeontological data. Instead, it appears that the basal portion of the Cadna-owie Formation is non-marine (probably lacustrine) in origin and that the overlying sandy units are paralic.

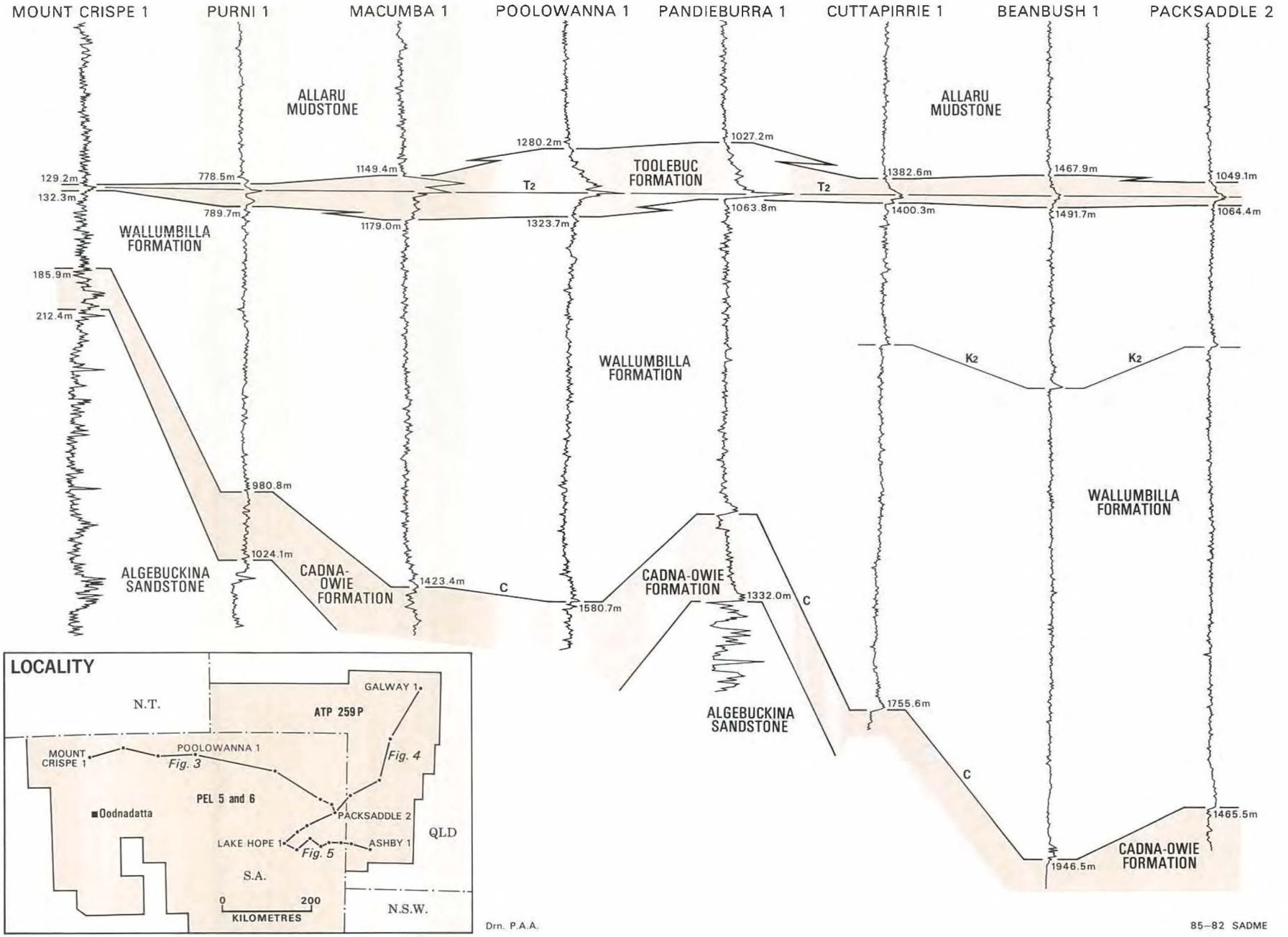

Figure 3. Gamma-ray cross-section, Mt Crispe 1 to Packsaddle 2.

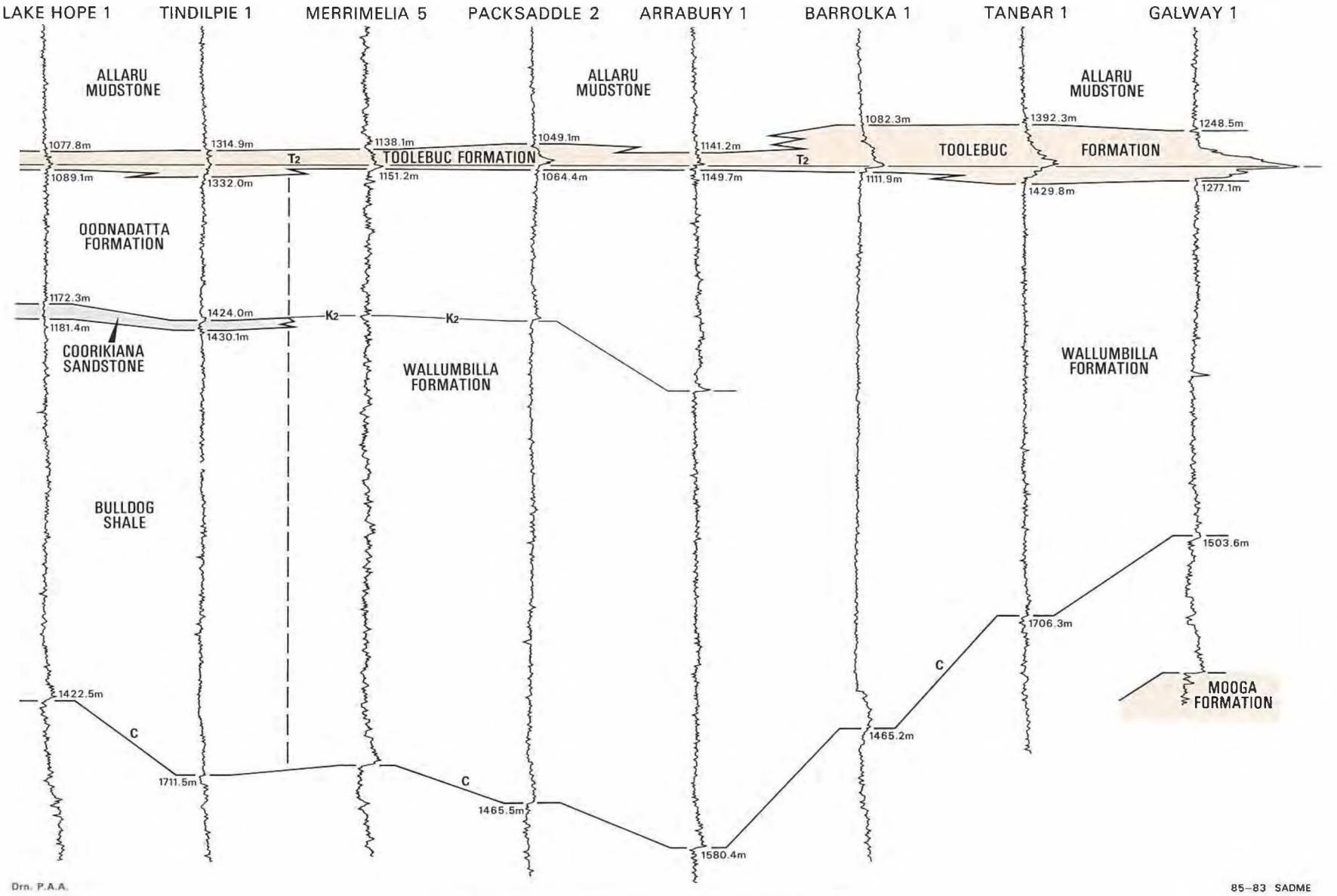

Figure 4. Gamma-ray cross-section, Lake Hope 1 to Galway 1.

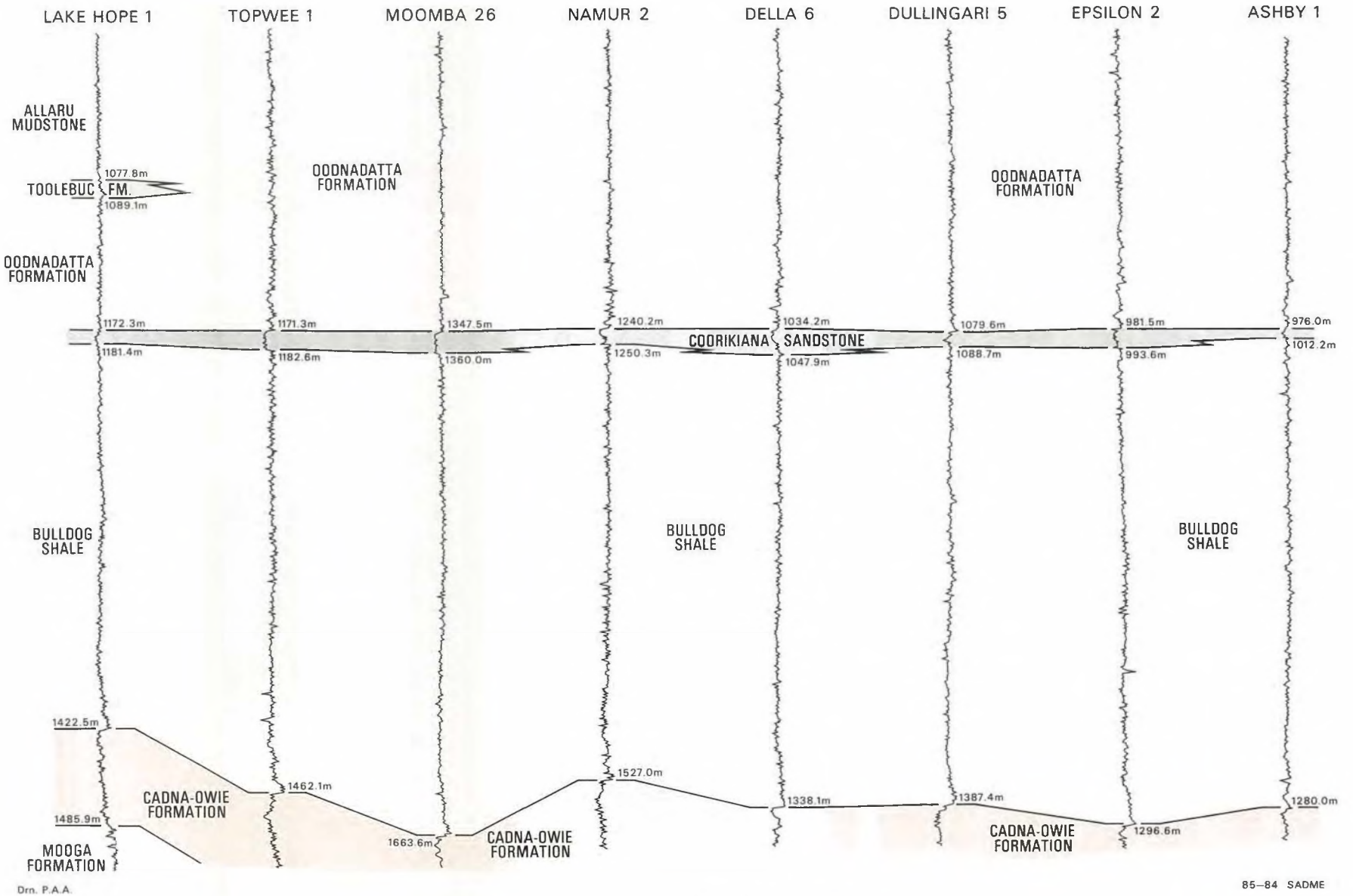

Figure 5. Gamma-ray cross-section, Lake Hope 1 to Ashby 1.

A connection with the open sea was established late in the Neocomian (Ambrose *et al.*, 1982; Burger, 1982b) with the uppermost Wyandra Sandstone Member and its lateral equivalents possibly including beach facies (Senior *et al.*, 1978) and lower-energy, marine shoreface deposits.

Stratigraphy and Depositional Environments of the Bulldog Shale

Definition

The Bulldog Shale was defined by Freytag (1966), who designated a type section 8 km south of Bulldog Creek, on the eastern side of the Peake and Denison Ranges, South Australia. In fresh outcrop the unit consists of 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 Shale extends into the subsurface and is 170 m thick in nearby Oodnadatta 1. As presently defined (Moore and Pitt, 1982a, b), it is overlain conformably by Coorikiana Sandstone and rests conformably on Cadna-owie Formation (Fig. 2). The formation reaches its maximum known thickness of approximately 340 m on the southern flanks of the Nappamerri Trough, in the southern Cooper Basin (Fig. 6). It is lithologically indistinguishable from the laterally adjacent Wallumbilla Formation.

Age and palaeontology

General: Fossils encountered in the Bulldog Shale include bivalves, gastropods, ammonites, belemnites, brachiopods, foraminifera, radiolarians, ostracods, wood fragments, fish and other vertebrate remains, and echinoids (Freytag, 1964; Ludbrook, 1966; Scheibnerová, 1980).

The age of the Bulldog Shale has been considered Aptian to early Albian, with the Aptian-Albian boundary occurring in the upper portion of the unit (Ludbrook, 1978). The exact position of the boundary is uncertain, due to the impoverished nature of the ammonite fauna in this part of the basin. However, Scheibnerová and Byrnes (1977) and Scheibnerová (1980) have suggested an early and middle Albian age for the upper part of the formation based on foraminiferal correlations.

Subsurface Data From PELs 5 and 6 and ATP 259P: Age control on the Bulldog Shale in the subsurface is provided most conveniently by spore-pollen and dinoflagellate assemblages. The lower boundary of the formation coincides broadly with the commencement of the *Dictyotosporites speciosus* spore-pollen Zone and the *Odontochitina operculata* dinoflagellate Zone (Fig. 2). The upper boundary of the formation is not so well defined, since it lies within the lower part of the *Coptospora paradoxa* spore-pollen Zone and the upper part of the *Pseudoceratium turneri* dinoflagellate Zone. However the contact between Bulldog Shale and the overlying Coorikiana Sandstone is now believed to coincide with the base of the *Pseudoceratium turneri* 'c' Subzone (Morgan, 1980) as shown in Figure 2.

It is not intended in this paper to discuss the problems of relating ages of palynological zones to the international time scale. The scheme used in Figure 2 is modified after Morgan (1977), and is consistent with local experience. A full listing of the palynological and dinoflagellate results presently available from within the study area is contained in Moore *et al.* (in press).

Distribution, lateral variation, and environment of deposition

Subsurface occurrences of Bulldog Shale are lithologically similar to those in the outcrop areas. Thin

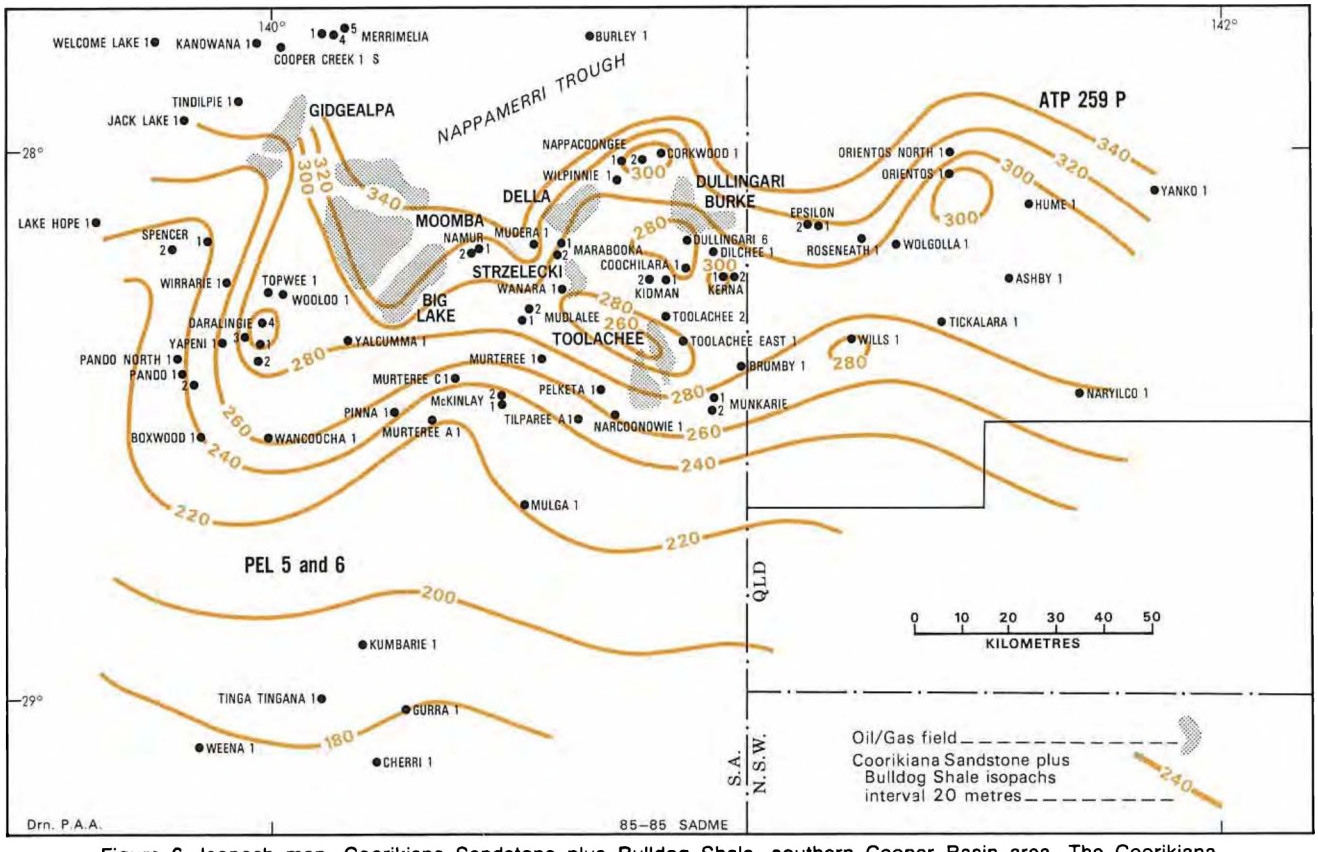

Figure 6. Isopach map, Coorikiana Sandstone plus Bulldog Shale, southern Cooper Basin area. The Coorikiana Sandstone has an average thickness of 5 to 10 m over most of this area, thus the isopach essentially shows the thickness of the Bulldog Shale.

calcareous interbeds are often concretionary layers rather than laterally continuous horizons. The lower one-third of the formation is particularly dark and shaly, and is probably a lateral facies-equivalent of the Doncaster Member of Wallumbilla Formation.

A distinctive unit, up to 25 m thick, occurs at the base of the Bulldog Shale and Wallumbilla Formation throughout the study area. The unit is characterised by high gamma-ray response and low sonic velocity, and was interpreted by Moore and Pitt (1982b) as an organic-rich shale. The sharp contact between this unit and the underlying sandstones of Cadna-owie Formation defines the 'C' seismic horizon. In outcrop, the equivalent stratigraphic interval is also a dark, organic-rich shale. Immediately northeast of Coober Pedy, the unit contains boulder-bearing sandstone lenses. The boulders, of probable reworked-glacial origin, are mostly Precambrian lithologies but a few are fossiliferous Devonian sandstones (Flint *et al.*, 1980).

The Bulldog Shale was deposited in a shallow-water marine environment. Regression terminated deposition of the unit and led to deposition of the overlying Coorikiana Sandstone.

Stratigraphy and Depositional Environments of the Coorikiana Sandstone

Definition

In the original definition of Oodnadatta Formation, Freytag (1966) defined the base as the bottom of a richly glauconitic and sandy interval which he termed the Coorikiana Member. The thickness of Coorikiana Member was given as eight metres in Oodnadatta 1. The type area lies in Coorikiana Creek, 40 km southwest of Oodnadatta township.

Subsequent mapping of the Cretaceous sequence, including the Coorikiana interval, was carried out over the Stuart Range region of central South Australia. Since the unit is predominantly a sandstone throughout its area of outcrop, it was renamed the Coorikiana Sandstone Member by Pitt and Barnes (1973). However, detailed mapping of the unit was made difficult by poor, discontinuous outcrop and very low dip. It is still unclear whether the Coorikiana Sandstone in outcrop is a single, continuous sand body, or a series of approximately laterally-equivalent sandstone lenses.

As the wide distribution of Coorikiana sandstones was realised, it became increasingly apparent that the Attraction Hill Sandstone Member of Marree Formation in the Marree area (Forbes, 1966) was a lateral equivalent, and that Coorikiana sandstones extend at least as far east as Marree. Acknowledging this, Thomson (1980) referred to the unit throughout its 600 km of outcrop as 'Coorikiana Sandstone'. Thomson's (1980) use of the term 'Coorikiana Sandstone' has since been accepted by Forbes (1982), Moore and Pitt (1982a, b; 1984) and others. Indeed, Moore and Pitt (1982b, 1984) and Moore *et al.* (in press) have recognised the unit even further eastwards, in the subsurface overlying the southern Cooper Basin.

As now mapped and defined, the Coorikiana Sandstone extends for nearly 1000 km around the margins of the southwestern Eromanga Basin (Fig. 1). It lies with apparent conformity between Oodnadatta Formation and Bulldog Shale, and comprises bioturbated, glauconitic sandstone with minor interbeds of greyish siltstone. In the subsurface, it is recognised as far west as Kopperamanna Bore (Townsend, 1971), and as far east as Yanko 1 in Queensland (Fig. 7).

Age and palaeontology

General: The Coorikiana Sandstone in its type area is undated. Age control on the formation in outcrop is derived from megafaunal determinations on adjacent shaly formations. Based on these determinations

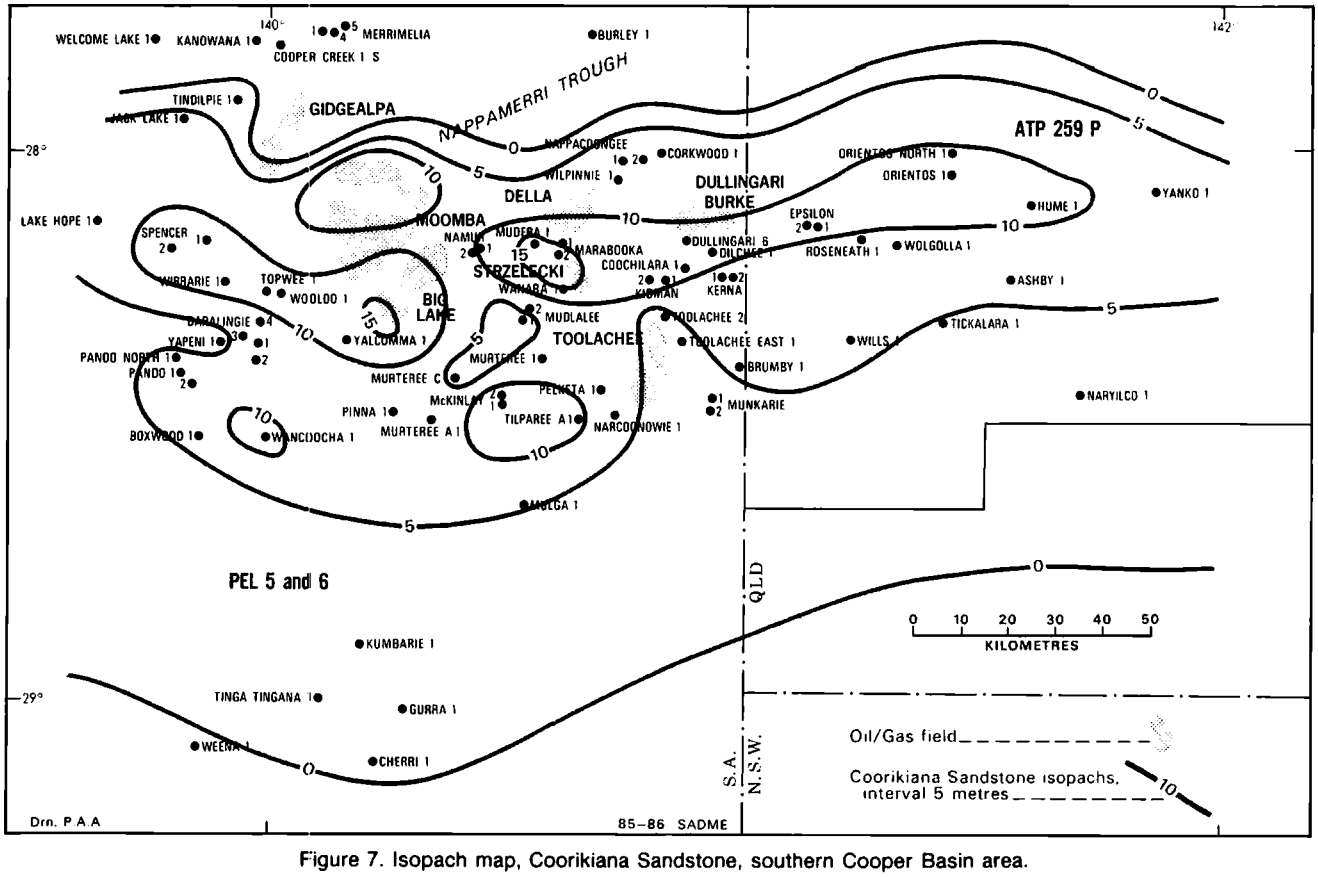

Figure 7. Isopach map, Coorikiana Sandstone, southern Cooper Basin area.

Ludbrook (1966) assigned the correlative Attraction Hill Sandstone Member an earliest Albian age. However precise determination of the Aptian-Albian boundary was hindered by a paucity of ammonites in the upper part of the underlying Marree Formation (*i.e.* upper Bulldog Shale).

Type Coorikiana Sandstone has been correlated with a glauconitic unit, extending from 131 m to 137 m in Oodnadatta 1 (Freytag, 1966; Ludbrook, 1966). This correlation was made initially on lithological grounds, and we support it.

Subsequent to Freytag's (1966) work, Oodnadatta 1 developed into a reference section for dinoflagellate and spore-pollen zonations. The greensand, now widely referred to as 'Coorikiana Sandstone', was assigned to the *C. paradoxa* spore-pollen Zone (Dettmann and Playford, 1969; Playford *et al.*, 1975) and the *P. turneri* 'c' dinoflagellate Subzone (Morgan, 1977). These authors placed the unit adjacent to the early-middle Albian boundary. However Scheibnerová (1980, 1982) places the greensand above her *Lingulogavelinella frankei* foraminiferal datum, and suggests a late Albian age for the unit.

Subsurface Data From PELs 5 and 6 and ATP 259P: The Coorikiana Sandstone lies within the *C. paradoxa* spore-pollen Zone and the *P. turneri* 'c' dinoflagellate Subzone, as indicated by data from McKinlay 1, Marabooka 1, Mudera 1 and Kidman 2 (Moore *et al.*, in press; Fig. 2). Determinations of *P. turneri* 'c' from immediately above the formation in McKinlay 1 (Dettmann and Price, 1982b) and Mudera 1 (Moore *et al.*, in press) suggest that Coorikiana Sandstone lies entirely within that subzone. If this is true then the Coorikiana Sandstone in the Cooper Basin area is coeval with marginal developments to the west, in Kalladeina water bore and in Oodnadatta 1, which are both assigned to the lower *P. turneri* 'c' Subzone (Morgan, 1980).

Distribution, lateral variation, and environment of deposition

In the subsurface of PELs 5 and 6 and ATP 259P, the Coorikiana Sandstone comprises a coarsening-upwards sequence of glauconitic sandstone and sandy siltstone, occasionally with minor siltstone interbeds. The sandstone is greenish-white to grey, very fine to fine-grained, and moderately sorted with a calcareous cement and argillaceous matrix. 'Coorikiana Sandstone' in Oodnadatta 1 has a similar lithology and a similar coarsening-upwards motif. In outcrop, the formation is poorly exposed, and little internal variation has been described. However, outcrops are commonly bioturbated and may be pebbly.

The Coorikiana Sandstone is now known to extend as a thin unit for over 1000 km around the south-western margins of the Eromanga Basin (Moore and Pitt, 1982b, 1984). The lateral continuity of the sandstone in outcrop is difficult to prove, because of poor exposure. However in the subsurface, well data indicate that the Coorikiana Sandstone is a continuous sand sheet showing a distinctive, coarsening-upward trend. The lithological uniformity of the sequence over such a large area, its coarsening-upwards nature, its lateral continuity and the gross shape of the sand body suggest that the Coorikiana Sandstone is a regressive, marine shoreface deposit. Deposition probably occurred in an epeiric sea, in response to a eustatic fall in sea level (Morgan, 1980).

Stratigraphy and Depositional Environments of the Oodnadatta Formation

Definition

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 rare limestone interbeds. It is at least 150 m thick in its type section at Mount Arthur, where it has an eroded top.

The base of the Oodnadatta Formation was originally defined by Freytag (1966) as the bottom of a thin glauconitic sandstone which he termed the 'Coorikiana Member'. The 'Coorikiana Member' has since been elevated to formational status (Moore and Pitt, 1982a,b; Moore *et al.*, in press) and excluded from the overlying Oodnadatta Formation.

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; Dettmann and Playford, 1969; Smart, 1972; Exon and Senior, 1976; Scheibnerová, 1980) although the correlation has yet to be proved beyond reasonable doubt (Moore *et al.*, in press). The Wooldridge Limestone Member contains abundant ammonites (Reyment, 1964a,b) as well as large molluscs, belemnites and foraminifera (Ludbrook, 1966).

In the upper part of the Oodnadatta Formation, an interval of glauconitic sandstone is known as the Mount Alexander Sandstone Member. This unit is considered to be a lateral equivalent of both Mackunda Formation and lower Blanchewater Formation, based on its lithological affinities (Krieg, in press), on the distribution of foraminifera (Scheibnerová, 1980) and on the presence of a restricted marine fauna in Oodnadatta 1 (Ludbrook, 1966, p. 27). The fossils consist mainly of arenaceous foraminifera and fish teeth, but include plant debris.

In the subsurface east of the Peake and Denison Ranges, the Oodnadatta Formation is defined as lying conformably between Mackunda Formation and Coorikiana Sandstone (Fig. 2). The Mount Alexander Sandstone Member is not defined in this area, probably because it is included in the Mackunda Formation. A similar situation occurs in the Dalhousie region, where Krieg (in press) has probably included the unit in the basal part of his 'Winton Formation'. These results suggest that the top of the Oodnadatta Formation should be taken at the base (rather that at the top) of the Mount Alexander Sandstone Member, where this latter unit is defined.

Age and palaeontology

General: The age of the Oodnadatta Formation is generally considered to be middle to late Albian (Ludbrook, 1966, 1978; McNamara, 1980), based on its ammonite fauna. Ammonites form a much less abundant 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, and this volume). In addition the formation contains bivalves, gastropods, nautiloids, belemnites, brachiopods, foraminifera, ostracodes, radiolarians, echinoids, fish fragments, spores and other plant debris (Ludbrook, 1966).

Subsurface Data From PELs 5 and 6 and ATP 259P: Based on evidence mainly from Marabooka 1, Mudera 1, McKinlay 1, Kidman 2 and Toolachee 9, the lower part of the Oodnadatta Formation lies within the *C. paradoxa* spore-pollen Zone, and the upper part belongs to the *P. pannosus* Zone (Fig. 2). The boundary between the *P. turneri* and *Endoceratium ludbrookiae* dinoflagellate zones appears to occur about 30 m above the top of Coorikiana Sandstone (Moore *et al.*, in press).

Distribution, lateral variation, and environment of deposition

In the subsurface of PELs 5 and 6 and ATP 259P, the Oodnadatta Formation is defined as lying conformably between Mackunda Formation and Coorikiana Sandstone or between Toolebuc Formation and Coorikiana Sandstone in the rare examples where these latter two units overlap (Fig. 2). Thus by definition, the Oodnadatta Formation is limited by the extent of the Coorikiana Sandstone.

The Oodnadatta Formation reaches a maximum thickness of about 300 m in the Moomba region, and thins gradually to the south (Fig. 8). It was deposited under low-energy marine conditions. Transgressions and regressions occurred during deposition, influencing the composition of the fauna, however shallow water conditions are thought to have predominated (Morgan, 1980).

Stratigraphy and Depositional Environments of the Wallumbilla Formation

Definition

The Wallumbilla Formation was defined by Vine *et al.* (1967). It had previously been referred to as 'Wollumbilla Formation' by Clarke (1865) and was included in the lower part of Casey's (1959) Wilgunya Formation. The unit varies considerably in thickness, from less than 30 m in some outcrops in the far northwest of the Eromanga Basin (Senior *et al.*, 1978) to over 450 m in the central Nappamerri Trough in South Australia (Moore and Pitt, 1982b, fig. 7). It is overlain conformably by Toolebuc Formation and rests conformably on Cadna-owie Formation. 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) reported rare, thin cone-in-cone limestone, and intraformational conglomerates. The unit is calcareous in parts, and may contain glauconite. *Inoceramus* fragments are common in the upper part of the unit, both in Queensland (Casey *et al.*, 1960) and in South Australia.

Age and palaeontology

General: An Aptian to Albian age has been assigned to the Wallumbilla Formation on the basis of a rich marine fauna, including bivalves, gastropods, belemnites, scaphopods, ammonites, brachiopods, crinoids, foraminifera, radiolarians, ostracodes and diatoms. In addition dinoflagellates, acritarchs and abundant plant debris including spores, pollen and fossil wood are present (Clarke, 1865, 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 Barnbaum, 1978). Palynological units from K1a to K1b have been recorded from the formation in Queensland (Burger in Senior *et al.*, 1969).

Subsurface Data From PELs 5 and 6 and ATP 259P: Data from the study area indicate that the Wallumbilla Formation extends from near the base of the *C. hughesi* spore-pollen Subzone to the *C. paradoxa* Zone (Fig. 2). Considerable subdivision of the sequence is also recognised on the basis of Morgan's (1977) dinoflagellate zones, with Wallumbilla Formation extending from *O. operculata* Zone (?Subzone 'a') to *P. turneri* Subzone 'c'.

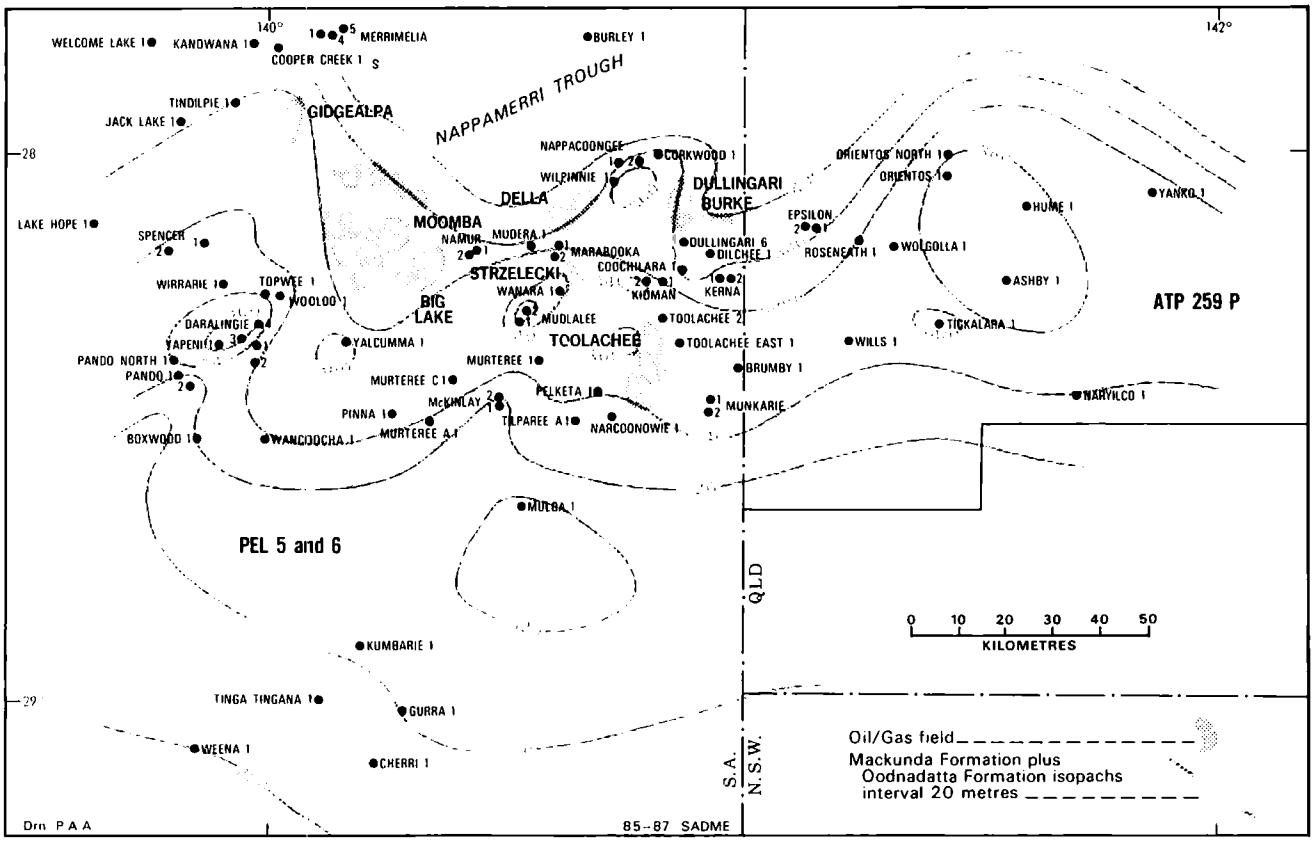

Figure 8. Isopach map, Mackunda plus Oodnadatta Formations, southern Cooper Basin area. The Mackunda Formation is variable in thickness, but averages 80 m in the study area.

Distribution, lateral variation, and environment of deposition

The distribution of the Wallumbilla Formation is, by definition, controlled by the distribution of the overlying Toolebuc Formation (Figs 2 and 9). Maximum thickness occurs in the southern Cooper Basin region, with the Patchawarra and Nappamerri Troughs representing prominent depocentres (Moore and Pitt, 1982b, fig. 7). The Windorah Trough was also extant at this time.

In the central and southern Eromanga Basin, the Wallumbilla Formation has been divided into an upper, slightly sandy Coreena Member and a lower, shaly Doncaster Member (Senior *et al.*, 1978; Morgan, 1980b). While this general subdivision is apparent in PELs 5 and 6 and ATP 259P, the members are not easily mapped using electric logs due to the subtlety of the facies change involved.

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

Stratigraphy and Depositional Environments of the Toolebuc Formation

Definition

The Toolebuc Formation was originally defined as a member of the Wilgunya Formation. It was later referred to as Toolebuc Limestone (Vine *et al.*, 1967) and was finally named Toolebuc Formation by Senior *et al.* (1975), who designated a type section in BMR Boulia 3A in Queensland. The formation comprises dominantly dark grey to black siltstone and mudstone with subordinate limestone (including coquinite). In most of PELs 5 and 6 and ATP 259P, limestone is absent.

The Toolebuc Formation is overlain conformably by Allaru Mudstone, and conformably overlies Wallumbilla Formation (Fig. 2). Formation boundaries are taken to correspond with top and bottom of the gamma-ray anomaly (Figs 3-5). South of the Nappamerri Trough the gamma-ray anomaly and associated lithologies are absent due to a facies change, so the Toolebuc Formation is not recognised in this area (Fig. 9).

Ozimic (1982a, fig. 1; in press) has suggested that use of the name Toolebuc Formation should be confined to areas where the unit contains oil-shale. Since oil-shale content is obtained by chemical analysis, such a technique would render the formation unmappable by normal geological techniques.

We have chosen the top and bottom of the gamma-ray anomaly as the limits of the Toolebuc Formation, because:

a) they are the generally accepted boundaries used by two decades of workers (see Senior *et al.*, 1978);

b) they are easily mappable; and

c) the high gamma-ray response corresponds with dark grey to black shales, marls and *Inoceramus* coquinites lithologically typical of Toolebuc Formation.

We find no evidence in PELs 5 and 6 and ATP 259P to support Ozimic's (1982b; in press) hypothesis that the high gamma-ray response is a feature which occurs independent of Toolebuc lithologies. This matter is discussed in detail by Moore *et al.* (in press), and by Moore and Pitt (1984).

Age and palaeontology

General: The Toolebuc Formation is Albian in age (Fig. 2) and contains abundant sessile bivalves (particularly *Inoceramus* and *Aucellina*) as well as fish fragments, gastropods, belemnites, radiolarians,

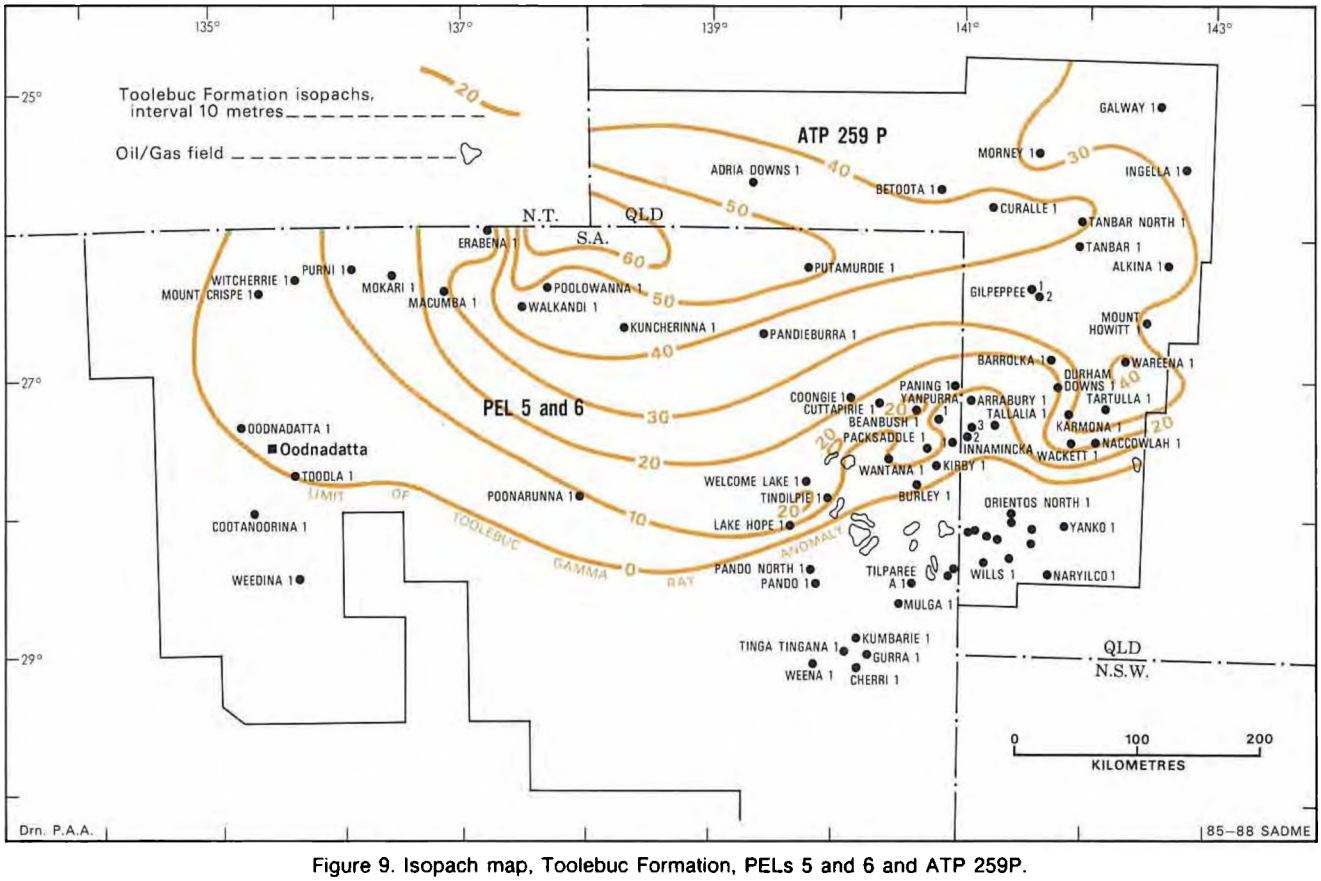

Figure 9. Isopach map, Toolebuc Formation, PELs 5 and 6 and ATP 259P.

planktonic foraminifera, and dinoflagellates (Crespin, 1963; Day, 1966, 1968, 1969; Terpstra, 1967; Vine and Day, 1965; Burger, 1982a). A K2 microflora (Evans and Burger in Exon *et al.*, 1972) supports an Albian age. More specifically, McMinn and Burger (in press) assign the formation in Queensland to the basal part of the *P. pannosus* spore-pollen Zone. Vertebrate remains were reported from the formation in Queensland by Casey (1959) and Vine and Day (1965).

Subsurface Data From PELs 5 and 6 and ATP 259P: Limited palaeontological data are available on the Toolebuc Formation in PELs 5 and 6 and ATP 259P. However, sidewall cores obtained from the formation in Morney 1 yielded the following (V. Scheibnerová, Geol. Surv. N.S.W., written communication):

Hedbergella sp.,

Ammodiscus sp.,

fish scales, teeth and bone fragments.

The fish fragments were obtained from a black, organic-rich marly shale which corresponds with the maximum gamma-ray anomaly.

In addition, Core 1 over the interval 1182-1284 m in the Toolebuc Formation in nearby Gilpeppee 2 yielded the following (N. H. Ludbrook, personal communication):

Inoceramus sutherlandi (McCoy),

Cyrenopsis corrugata (Tate),

Pseudavicula sp. of Ludbrook (1966),

Syncyclonema gradata (Etheridge Jr),

Aucellina hughendenensis (Etheridge),

fish scales.

Palynological data from the study area (Moore *et al.*, in press) suggest that the Toolebuc Formation is within the upper part of the *C. paradoxa* spore-pollen Zone (Fig. 2). However Burger (1981, 1982a), McMinn (1983), and McMinn and Burger (in press) place the *C. paradoxa* - *P. pannosus* zonal boundary at the base of the Toolebuc Formation, and thus attribute a slightly younger age to the formation in the central and northern Eromanga Basin. If in fact the Toolebuc Formation is younger in these areas, explanations for this could be:

a) Several critical sidewall core samples attributed to the *C. paradoxa* Zone from our study area (Moore *et al.*, in press) could be wrongly assigned, since the assignation is made purely on the basis of an absence of *P. pannosus*. Such an absence could conceivably be a palynofacies or sampling effect.

b) The Toolebuc Formation may be slightly diachronous, being oldest in the central, deepest parts of the Eromanga Basin, which lie within our study area.

c) Facies changes are known to occur between Toolebuc Formation and adjacent units (Figs 3-5). The age of the formation is thus partly controlled by the extent to which Toolebuc facies is developed.

Other more complex interpretations of these data are possible, and are discussed in detail by Moore *et al.* (in press). Resolution of this problem will depend on further sampling over a period of years. However a single determination of *P. turneri* 'c' dinoflagellate Subzone from within Toolebuc Formation at Wareena 1 (Filatoff and Price, 1971) supports a *C. paradoxa* age for at least the lower part of the formation (*cf.* Morgan, 1977, fig. 4).

Distribution, lateral variation, and environment of deposition

The Toolebuc Formation gamma-ray anomaly can be traced continuously from southwestern Queensland into northern South Australia (Figs 3 and 4). It extends across the Birdsville Track Ridge, and is particularly well developed in the Simpson Desert region where it reaches a maximum local thickness of about 60 m.

Thickness variations in the Toolebuc Formation in PELs 5 and 6 and ATP 259P are largely unrelated to rates of subsidence. The formation is absent from the southern margin of the Eromanga Basin due to input of terrigenous clastics which over-rides the normal euxinic character of the unit. Conversely, the Toolebuc Formation thickens away from the margins of the Eromanga Basin, presumably due to a decrease in the input of terrigenous clastics (Fig. 9).

The extent of the Toolebuc Formation west of the Simpson Desert region is unclear. The sequence thins very markedly westwards, so that the presence of Toolebuc Formation in Mt Crispe 1 and Witcherrie 1 is uncertain (Fig. 3). In outcrop around Oodnadatta, the Wooldridge Limestone Member of the Oodnadatta Formation has commonly been regarded as a lateral equivalent of Toolebuc Formation (Scheibnerová, 1980; and others). However, the lithologies are somewhat different with the Wooldridge Limestone Member comprising dominantly an ammonite-rich buff sandy limestone in outcrop. This unit has been correlated with a thin calcareous interval in Oodnadatta 1 (Freytag, 1966), associated with the *P. pannosus* Zone (Playford *et al.*, 1975), and the *E. ludbrookiae* 'a' Subzone (Morgan, 1977). If this correlation is correct, the Wooldridge Limestone Member would appear to be slightly younger than the Toolebuc Formation in our study area (see Fig. 2). Certainly, a correlation between type Wooldridge Limestone Member and Toolebuc Formation should not be assumed, and indeed at present is impossible to prove. The very limited distribution of Wooldridge Limestone Member in outcrop adds further to the difficulties in correlating this unit.

The most detailed study of the Toolebuc Formation in PELs 5 and 6 and ATP 259P was conducted in Morney 1, in southwestern Queensland. In this well, Moore *et al.* (in press) recognise three lithotypes which can be correlated with variations in gamma-sonic log response. The lithotypes are:

a) black, calcareous mudstone (high gamma-ray response);

b) dark grey mudstone (moderate gamma-ray response);

c) dark grey fossiliferous mudstone or coquinite (moderate gamma-ray response combined with high sonic velocity).

The gamma-ray anomaly which characterises Toolebuc Formation is due to the presence of uranium. Ramsden *et al.* (1982) have shown that the uranium in Toolebuc Formation is primarily associated with organic matter in oil-shales, and with phosphatic skeletal fish debris in accompanying coquinites. In the Toolebuc Formation in PELs 5 and 6 and ATP 259P, carbonaceous intervals are rich in fossil fish debris, so the primary source of the uranium (organic matter *vs* fish remains) is unclear.

The environment of deposition of the Toolebuc Formation has been discussed by many workers, the most recent results being contained in Moore and Mount (1982a, b) and Gravestock *et al.* (in press). It is now apparent that the Toolebuc Formation was deposited in a quiet-water, restricted-marine environment. Ozimic

(1982a; in press) and Glikson (1982) have suggested that the sea was stratified, with a permanent halocline below a layer of fairly fresh water.

Although Toolebuc oil shales appear to be restricted to Queensland (Saxby, 1982; Ozimic,1982a,b; in press), the carbonaceous facies of the formation with its high gamma-ray response is well developed in the northern parts of PELs 5 and 6 and ATP 259P. The dark coloured facies, its non-bioturbated nature and the absence of a benthonic fauna suggest strong oxygen depletion in the lower portion of the water column and possibly also in the substrate. The calcareous nature of the black mudstones and the abundance of carbonaceous matter suggest slow deposition, possibly with more hospitable conditions for organisms occupying the upper portion of the water column. According to Sherwood and Cook (in press) Toolebuc oil shales comprise mostly bituminite, probably derived from planktonic or benthonic algae. They suggest that the oil shales were deposited mainly in a distal, offshore, marine shelf environment.

Stratigraphy and Depositional Environments of the Allaru Mudstone

Definition

The Allaru Mudstone, originally assigned to the upper part of the Wilgunya Formation (Casey, 1959), was termed the Allaru Member by Vine and Day (1965) before finally being elevated to formational status by Vine *et al.* (1967). Its type section occurs along the main Richmond-Winton Road on the Richmond sheet in Queensland. The Allaru Mudstone comprises mainly grey mudstone with thin interbeds of calcareous siltstone and minor very fine-grained sandstone. Thin concretionary limestones also occur in the sequence. The Allaru Mudstone is overlain conformably by Mackunda Formation, and is underlain conformably by Toolebuc Formation.

Age and palaeontology

General: The Allaru Mudstone is Albian in age, based on its varied fossil content and the age of adjacent sequences. Marine fossils include abundant bivalves, common ammonites and microplankton, as well as foraminifera, gastropods and belemnites (Day, 1966, 1968, 1969; Burger, 1968; Terpstra, 1968). Microplankton and a K2 microflora are also recorded (Burger, 1968).

Subsurface Data From PELs 5 and 6 and ATP 259P: Palynological results are available from the Allaru Mudstone in Naccowlah 1 (Dettmann and Price, 1981) and Wareena 1 (Filatoff and Price, 1981) in the Queensland portion of the study area, and from Packsaddle 3 (Price, 1979a) in South Australia. The sequence is assigned to the *P. pannosus* microfloral Zone (Fig. 2).

Dinoflagellates recovered from a sidewall core in the lower part of the formation in Naccowlah 1 were assigned to the *E. ludbrookiae* Zone by Dettmann and Price (1981).

Distribution, lateral variation, and environment of deposition

The Allaru Mudstone extends from Queensland, through northeastern South Australia, into the Simpson Desert region. Its extent is limited by the extent of the underlying Toolebuc Formation (Fig. 2) so it is absent, by definition, from the southernmost Cooper Basin south of the Nappamerri Trough.

Thickness variations in the Allaru Mudstone are a response to two factors:

a) degree of structural downwarp during deposition; and
b) degree of development of the overlying Mackunda facies and the underlying Toolebuc facies.

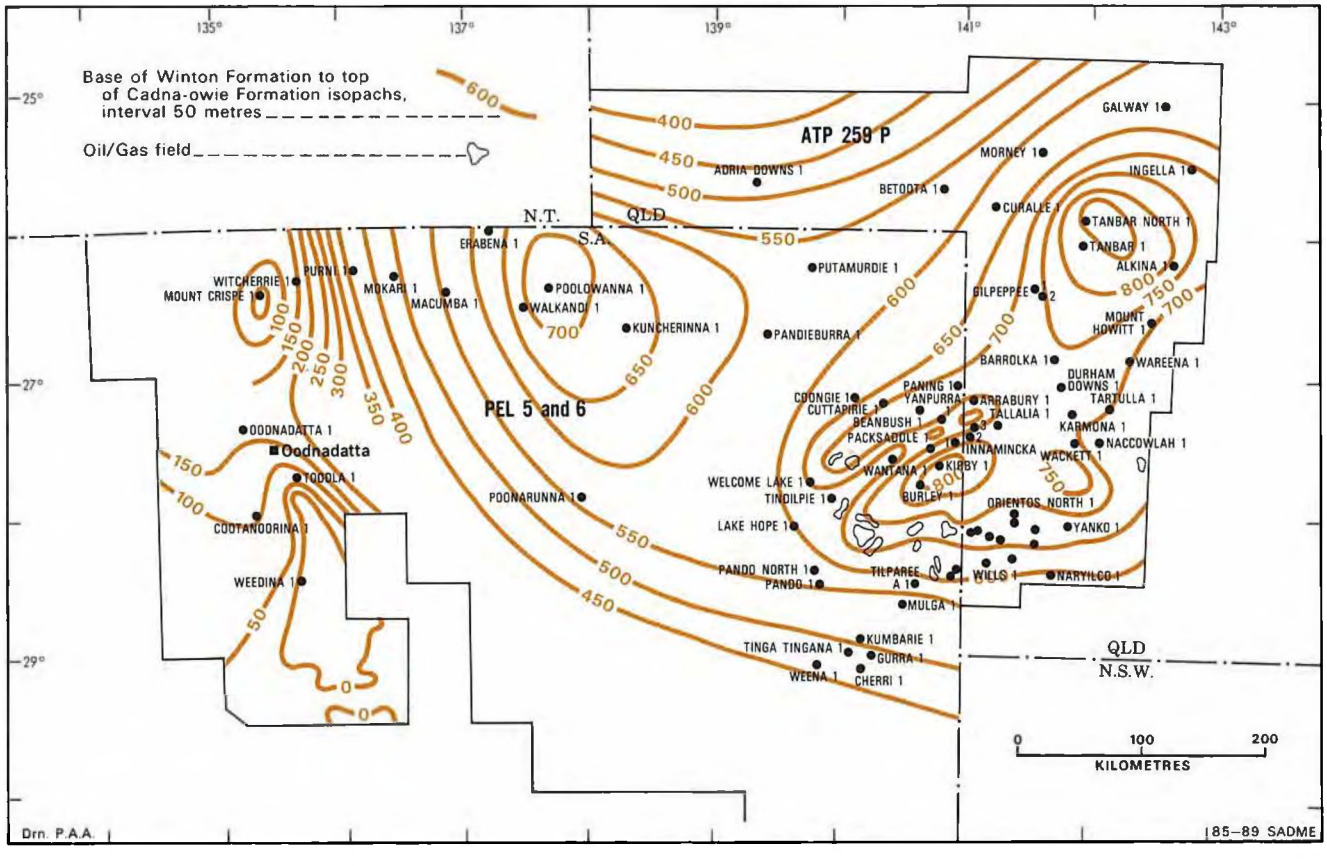

Figure 10. Isopach map, base Winton Formation to top Cadna-owie Formation.

Lateral facies transitions occur from the Allaru Mudstone into adjacent formations. Although they are not very significant, they downgrade the usefulness of Allaru Mudstone as a mapping interval for structural analysis. Structural growth in the southwestern Eromanga Basin during the Aptian-Albian is better illustrated by isopachs of the sequence from the base of Winton Formation to the top of Cadna-owie Formation (Fig. 10), since neither of these boundaries is significantly facies-controlled. Figure 10 shows the major influence of the Windorah, Nappamerri and Poolowanna Troughs during Early Cretaceous deposition, with the Patchawarra Trough having lesser influence on sedimentation.

Maximum recorded thickness of Allaru Mudstone in the southwestern Eromanga Basin is 344 m at Tanbar North 1 in the Windorah Trough (Moore and Pitt, 1982b). A considerable thickness (288 m) is also recorded in Burley 1, on the northern flank of the Nappamerri Trough.

Based mainly on its fossil content the Allaru Mudstone is interpreted as a shallow, quiet-water marine deposit. It is laterally equivalent to the middle and upper parts of the lithologically indistinguishable Oodnadatta Formation which is recognised further south, towards the margins of the Eromanga Basin.

Stratigraphy and Depositional Environments of the Mackunda Formation

Definition

The Mackunda Formation (Vine and Day, 1965) lies conformably on Allaru Mudstone and Oodnadatta Formation, and is overlain conformably by Winton Formation. It comprises interbedded sandstone, siltstone and shale which is calcareous in part. It is distinguished from underlying formations by its sandy aspect, and from the overlying Winton Formation by its slightly more sandy aspect, the virtual absence of coal, and a marine fauna.

In the subsurface of the southwestern Eromanga Basin, the boundary between the Mackunda Formation and adjacent units is most easily detected using the gamma-ray/sonic log. The presence of carbonaceous beds, calcareous beds and calcareous-cemented sandstone is immediately apparent using this technique (Fig. 11).

Age and palaeontology

General: The Mackunda Formation is late Albian in age, based mainly on a K2 microflora (Burger, 1968). The megafossil collection includes bivalves, ammonites, gastropods, belemnites, polyzoans, shark teeth, foraminifera and wood fragments (Crespin, 1963; Day, 1966, 1967, 1969; Day in Gregory *et al.*, 1967). Dinosaur remains are reported by Bartholomai and Molnar (1981).

Faunal and floral data from the Mackunda Formation in South Australia are still sparse, and it is not known whether the unit has marine affinities throughout the area. However, the equivalent section near Marree (lower part of Blanchewater Formation) contains marine fossils of Albian age (Ludbrook, 1966).

Subsurface Data From PELs 5 and 6 and ATP 259P: Palynologically, the Mackunda Formation generally lies within the *P. pannosus* Zone (M. E. Dettmann and P. L. Price, personal communication; Burger, 1982b). However, attempts at dating the formation within PELs 5 and 6 and ATP 259P have yet to yield definitive results.

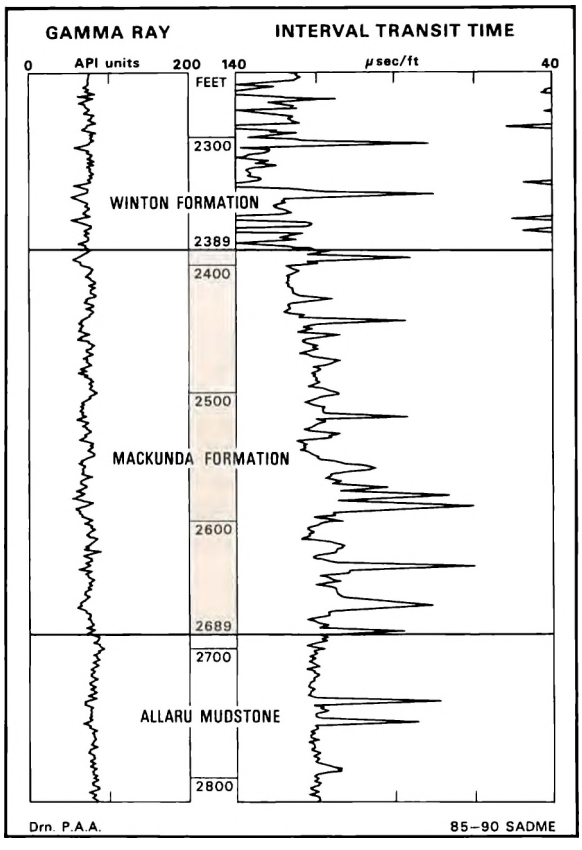

Figure 11. Gamma-sonic log of Mackunda Formation, Dullingari 11, South Australia.

Distribution, lateral variation, and environment of deposition

The Mackunda Formation averages 60 m in thickness in the central Eromanga Basin (Senior *et al.*, 1978), but thickens to the southwest. 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 the southwestern Eromanga Basin in the subsurface, maintaining a thickness of the order of 100 m. The environment of deposition is interpreted as marginal-marine to paralic, on the basis of its fossil content and its stratigraphic position between marine and non-marine sediments. Deposition probably occurred along a low-energy shoreface in response to a basin-wide regression near the end of the Albian.

Stratigraphy and Depositional Environment of the Winton Formation

Definition

The Winton Formation (originally termed the Winton Series by Dunstan, 1916) is a sequence of grey shale, siltstone and sandstone, with minor coal interbeds. It rests conformably on the Mackunda Formation and is overlain unconformably by Cainozoic sediments attributed variously to the Lake Eyre Basin (Wopfner and Twidale, 1971) or the Birdsville Basin (Veevers and Rundle, 1979). The type area, designated by Whitehouse (1955, p. 10), is described as 'the blue shales and sandstones with intercalated coal seams met within the bores in and about Winton', Queensland.

'Winton Formation' as mapped in outcrop around Oodnadatta in South Australia is probably a lateral equivalent of type Mackunda Formation and ?basal

Winton Formation. This view has also been expressed by Krieg (in press) and Forbes (1982). Indeed, Forbes (1982, p. 123) has recommended that in future, an endeavour should be made to subdivide outcropping 'Winton Formation' in South Australia, and to map both Winton Formation and Mackunda Formation. If this can be achieved, it will provide a consistency of nomenclature throughout the Eromanga Basin.

In the subsurface in PELs 5 and 6 and ATP 259P, the Winton Formation is easily distinguished by its carbonaceous nature. Thinly interbedded calcareous sandstones (with a high sonic velocity) and carbonaceous shales and coals (with low sonic velocities) combine to produce a very erratic trace on the sonic log (Fig. 11). The base of the Winton Formation is generally taken at the base of the stratigraphically lowest coaly horizon. The underlying Mackunda Formation is sandier, and is characterised by more consistent and generally higher sonic velocities (Fig. 11).

Age and palaeontology

General: The Winton Formation has been tentatively assigned a Cenomanian age (Fig. 2), based mainly on the presence of angiosperm leaves (White, 1966, 1974) and post-K2b palynomorphs (Burger in Exon *et al.*, 1972; Burger, 1982). 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, 1966; White, 1962, 1964).

Subsurface Data From PELs 5 and 6 and ATP 259P: Palynological analysis of the Cretaceous sequence in PELs 5 and 6 and ATP 259P was conducted in a few petroleum wells in the early 1960s, then recommenced for a trial period in 1980-1981. At present, there are virtually no palynological data available from the Winton Formation in this area. A sidewall core from the lower part of the formation in Naccowlah 1 yielded an assemblage which was provisionally assigned to the *P. pannosus* Zone (Dettmann and Price, 1981).

Distribution, lateral variation, and environment of deposition

The Winton Formation occurs as outcrop or shallow subcrop over large parts of southwestern Queensland, and extends into South Australia, New South Wales and the Northern Territory. In PELs 5 and 6 in South Australia it is generally buried beneath a cover of Cainozoic sediments which in places exceeds 150 m in thickness (Wasson, 1983a, b).

Maximum thickness of Winton Formation in the study area is about 1200 m, in the centre of the Patchawarra Trough (Fig. 12). Considerable thicknesses also occur in the Nappamerri, Windorah and Poolowanna Troughs, which were actively subsiding in the Late Cretaceous.

The formation has been subject to Tertiary uplift and erosion in much of ATP 259P, however the effects of tectonism are much less pronounced in South Australia (Moore and Pitt, 1984). The Gidgealpa-Merrimelia-Innamincka (GMI) Ridge, separating the Patchawarra and Nappamerri Troughs, was certainly reactivated in the Tertiary, as shown by dipping silcretes on the flanks of the Innamincka dome (Sprigg, 1982). In Queensland, major structures flanking the Tanbar Trough are mostly youthful, postdating the deposition of Winton Formation.

The depositional environment of the Winton Formation was non-marine, generally low-energy meandering fluvial to paludal. Whereas coals and carbonaceous shales are abundant in the subsurface, they are relatively uncommon in outcrop in South Australia. This facies change is a reflection of an increase in depositional energy associated with the basin-margin environment. Due to a paucity of coal, Winton Formation and Mackunda Formation are difficult (and sometimes impossible) to differentiate in outcrop areas around Oodnadatta, Dalhousie and Marree. In these cases,

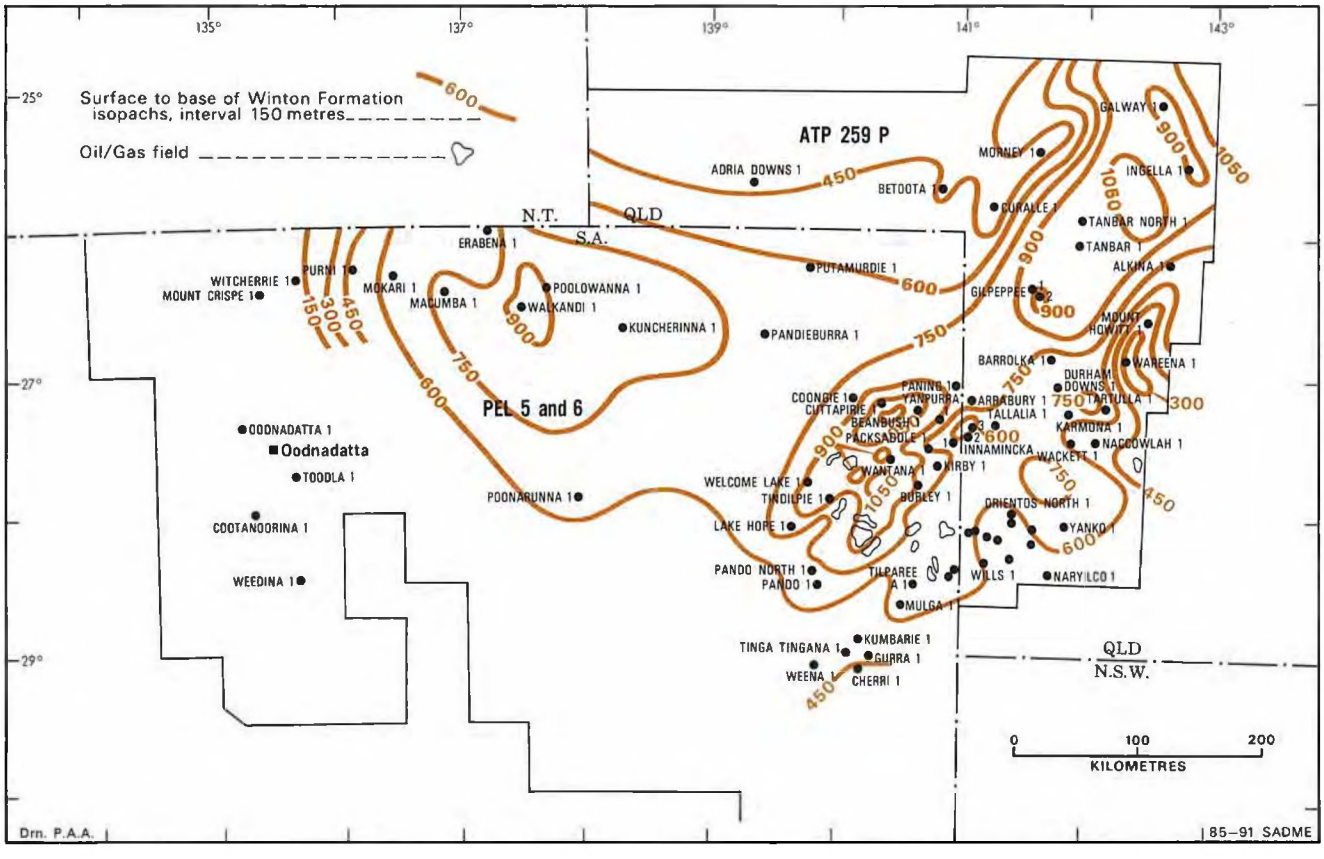

Figure 12. Isopach map, surface to base of Winton Formation, PELs 5 and 6 and ATP 259P.

the term 'Blanchewater Formation' (equivalent to Winton plus Mackunda; Forbes, 1966) may be a more appropriate nomenclature for this undifferentiated Albian-Cenomanian sandy sequence.

Discussion and Conclusions

Until recently, the sequence above the Cadna-owie Formation was of little interest to oil companies operating within the Eromanga Basin. However, with the discovery of oil in the Jurassic sequence in 1978, attention has become increasingly focussed on younger rocks, including Aptian-Cenomanian units.

One of the first tasks associated with this new orientation was to establish accurate electric log correlations throughout PELs 5 and 6 and ATP 259P, and to determine the age of various units. As the work progressed, it became increasingly apparent that the 'Roma-Tambo' nomenclature used by oil companies for the Aptian-Albian sequence was inadequate. The new scheme which evolved (Moore, 1981; Moore and Pitt, 1982b) has been in use since 1981, and has the capacity to describe all of the stratigraphic variations which are known to occur within the sequence. The new scheme uses existing nomenclature, and ties in with the work conducted in the Northern Territory and Queensland by the Bureau of Mineral Resources (Senior *et al.*, 1978).

It has been the purpose of this paper to review the stratigraphy and depositional environments of the various Cretaceous units with an emphasis on their nature, distribution and age in the subsurface. Although much has been written about the various units in outcrop, very little published material is presently available on their subsurface occurrence, particularly in South Australia. The results presented herein take into account data available from nearly 500 petroleum wells, distributed over one-third of the area of the Eromanga Basin.

Probably the most outstanding feature of the Cretaceous sequence of the southwestern Eromanga Basin is the lateral continuity of units, and their lithological similarity over very large distances. It would appear therefore that deposition occurred in and adjacent to an epeiric sea, similar to the shallow epicontinental sea which inundated central North America in the Cretaceous.

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