D.B.

DEPARTMENT OF
MINERALS AND ENERGY

# BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS



Record 1973/102



## GEOLOGICAL AND PALYNOLOGICAL OBSERVATIONS ON THE CRETACEOUS OF THE NORTHWESTERN EROMANGA BASIN, QUEENSLAND AND NORTHERN TERRITORY

by

D. Burger and A. Mond

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## SUMMARY

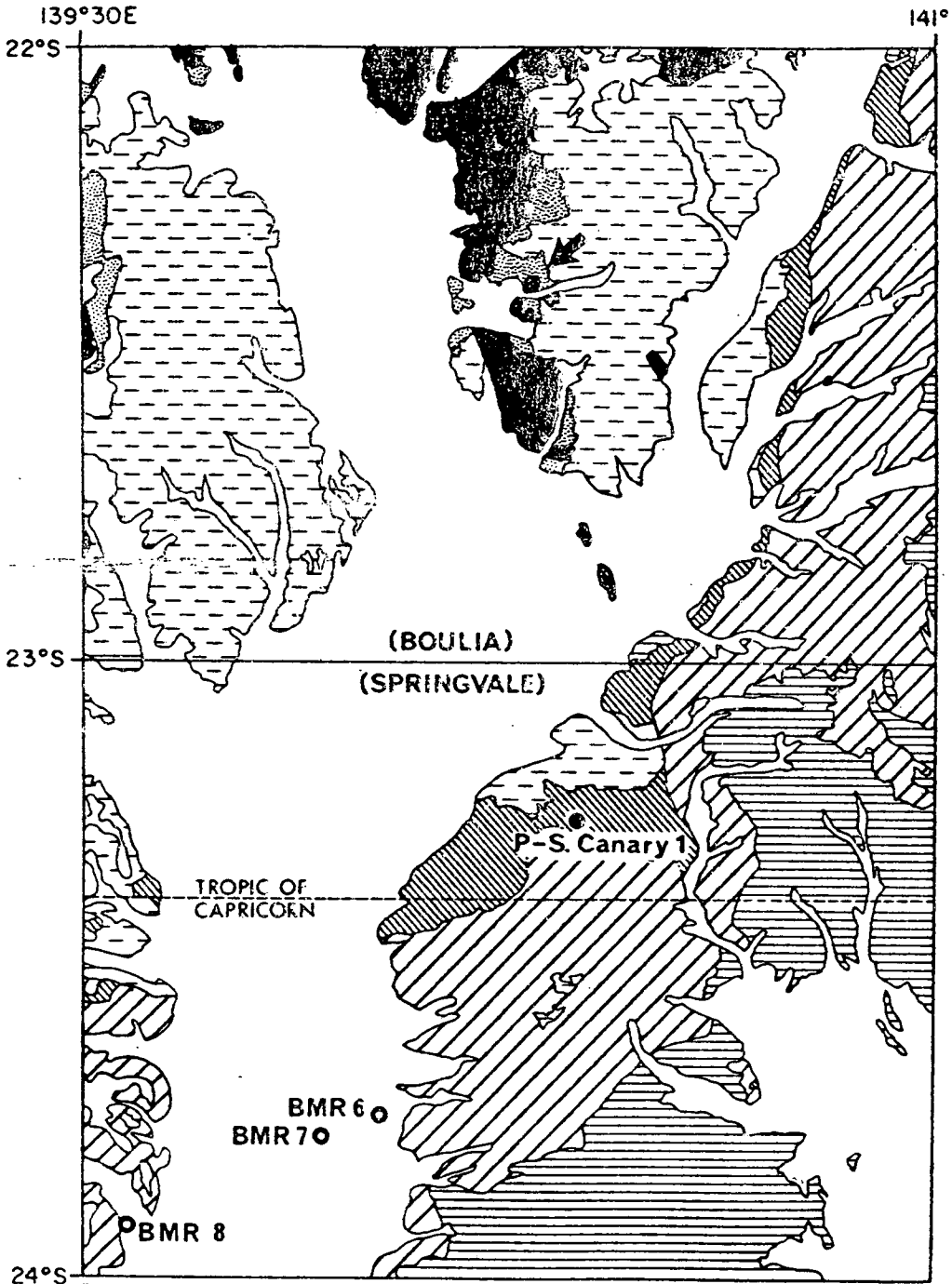
Recent shallow stratigraphic drilling by the Bureau of Mineral Resources (BMR) in the Springvale and Hay River 1:250 000 Sheet areas, Queensland and Northern Territory respectively, provided an opportunity for comparative palynological study of the Lower Cretaceous of the north/western Eromanga Basin. The Mesozoic sediments drilled were identified, in stratigraphic order, as the Longsight Sandstone, Wallumbilla Formation, Toolebuc Limestone, and Allaru Mudstone. Aptian and Albian microfloral assemblages were extracted from cores and cuttings of these sediments. Stratigraphic conclusions, though still incomplete, are sufficient to show that the palynological sequence is in many respects similar to that described from other parts of the Great Artesian Basin. Palynological units K1a, K1b-c, K1d, K2a and K2b were identified. In the basal part of the rock sequence of the Hay River area there is distinct evidence of strongly overlapping sedimentation (Longsight Sandstone). The association of unit K2a with the Toolebuc Limestone, and unit K2b with the Allaru Mudstone is consistent with the findings of previous work in the Eromanga and southern Carpentaria Basins.

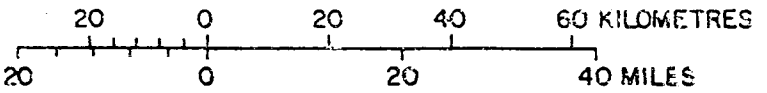
TABLE 1. DETAILS OF PALYNOLOGICALLY EXAMINED ROCK SAMPLES

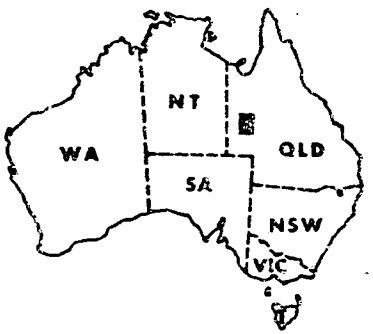
| SHEET AREA | ROCK UNIT | WELL/BORE | DEPTH | MFP. | ZONE AFFINITY |
|---|---|---|---|---|---|
| Spring-vale | Toolebuc? | P.-S. Canary 1 | 15.2-18.2 | 5865 | unknown |
| | Wallumbilla | , | 87.17 | 5864 | Ding. cerviculum |
| | Longsight | , | 152-155 | 5866 | unit K1a? |
| | Toolebuc | BMR Springvale 6 | 50.65 | 5859 | units K2 |
| | , | , | 50.54 | 5742 | insuff. recovery |
| | , | , | 51.05 | 5858 | insuff. recovery |
| | , | , | 52.22 | 5860 | units K2 |
| | , | , | 53.17 | 5857 | insuff. recovery |
| | Wallumbilla | , | 90.93 | 5743 | insuff. recovery |
| | , | , | 90.96 | 5853 | unit K2a |
| | Allaru | BMR Springvale 7 | 32.08 | 5856 | unit K2b |
| | , | , | 33.05 | 5861 | insuff. recovery |
| | , | , | 33.22 | 5744 | insuff. recovery |
| | Allaru | BMR Springvale 8 | 17.83 | 5854 | barren |
| | , | , | 17.96 | 5746 | barren |
| | , | , | 18.08 | 5855 | barren |
| | , | , | 55-58 | 5867 | unit K2b |
| | Wallumbilla | , | 70-73 | 5863 | unit K2a? |
| Hay River | Allaru | BMR Hay River 2 | 91-94 | 5827 | unit K2b |
| | Longsight | , | 183-186 | 5828 | contaminated |
| | , | , | 189-192 | 5834 | contaminated |
| | Longsight | BMR Hay River 3 | 143.26 | 5838 | unit K1a-b |
| | , | , | 143-146 | 5814 | unit K1a? |
| | , | , | 144.48 | 5839 | unit K1a-b |
| | Allaru | BMR Hay River 4 | 56-59 | 5668 | insuff. recovery |
| | , | , | 56.84 | 5829 | unit K2b |
| | Longsight | , | 113-116 | 5835 | unit K2a |
| | , | , | 165-168 | 5836 | unit K1d? |
| | , | , | 173.7-176.7 | 5816 | contaminated |
| | , | , | 183-186 | 5837 | unit K1b-c |
| | , | , | 186-189 | 5817 | unit K1b-c |
| | , | , | 189-192 | 5818 | contaminated |

# GEOLOGY OF SPRINGVALE - BOULIA AREA & LOCATION OF SECTIONS

FIGURE 1




Cainozoic (mainly Quaternary)

Mackunda Formation

Allaru Mudstone

Toolebuc Limestone

Wallumbilla Formation (undiff.)

Longsight Sandstone (arrow indicates type section)

Lower Palaeozoic & crystalline basement

To accompany Record 1973/102

Compiled from: Geological map Western Eromanga Basin, by R.R. Vine & S. Daric, 1969

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## INTRODUCTION

Regional mapping in the northwestern Eromanga Basin has indicated broadly uniform development of the marine Rolling Downs Group throughout the Basin, but palaeontological information is limited, particularly in the Northern Territory. Fossils collected from the Longsight Sandstone in the Boulia area, north of Springvale, resemble the late Aptian 'Roma' fauna (Reynolds, In Hill & Denmead, 1960). From comparable parts of the rock sequence in South Australia Ludbrook (1966) described Aptian and Albian Foraminifera, but lack of detailed comparison of the rock nomenclature in South Australia and Queensland prevents direct application of Ludbrook's results in Queensland. Attempts to correlate palynological assemblages in South Australia, which were dated on the basis of Ludbrook's work, with palynological sequences in New South Wales resulted in apparent discrepancy with regard to the position of the Aptian-Albian boundary (Evans & Hawkins, 1967). Much more detailed work needs to be done.

Subsurface material obtained from recent shallow stratigraphic drilling in the Hay River and Springvale areas provided an opportunity for palynological reconnaissance work in the northwestern Eromanga Basin. Although part of the material selected (15 out of 32 samples; see Table 1) gave insufficient information, the emerging pollen-stratigraphic picture is in essence similar to that from contemporaneous sediments elsewhere in the Great Artesian Basin. In addition, useful information was obtained on palynological unit K2a.

This report discusses the occurrence of certain stratigraphically important spore and pollen species; dinoflagellates and other microfossils listed do not contribute much to the regional palynostratigraphy, as vertical ranges of most of the species are still poorly documented.

## SPRINGVALE SHEET AREA

A substantial thickness of Mesozoic sediments was described during regional mapping of the Boulia and Springvale 1:250 000 Sheet areas, northwestern Eromanga Basin, Queensland (Casey, et al., 1960; Reynolds, 1965). Marine faunas of Cretaceous age were described, among others, by Whitehouse (1955), Dickins (1960), and Crespin (1963). The geology of these areas is shown in Fig. 1.

Stratigraphic drilling in the Springvale area by Phillips-Sunray (Green et al., 1963), and BMR (Senior & Hughes, 1972) provided suitable samples for palynological examination. Drilled sections from which samples were selected are shown in Figure 2.

The oldest Mesozoic sediments directly overlying basement were penetrated in P.-S. Canary 1 Well (lat. 23°158' 30" S., long. 140°22' 30"E.). Green et al. (op. cit.) recorded the occurrence of the Longsight Sandstone from 510-470 feet (155.5-143.3 m). Examination of cuttings from the sandstone gave moderately successful results. A sample from 152-155 m depth (MFP 5866) yielded the following species:

Spores:
- Biretisporites spectabilis
- Cyathidites australis & minor
- Leptolepidites major
- Lycopodiumsporites austroclavatidites
- Reticulatisporites pudens
- Dictyotosporites complex
- cf. Matonisporites cooksonae
- Microcachryidites antarcticus
- Alisporites grandis & similis
- Podocarpidites ellipticus
- Tricolpate form (contaminant)

Other:
- Dingodinium cerviculum (common)
- Chlamydophorella nyei
- cf. Diconodinium multispinum (contaminant?)
- aff. Palaeostomocystis sp.
- "Gen. et sp. indet. A" Eisenack & Cookson, 1960
- Pterospermopsis spp.
- Micrhystridium spp.

Although this well was drilled with the primary purpose of examining the rock sequence below the Mesozoic (Green et al., op. cit.), the first core in the section was cut in the argillaceous sequence ('Wilgunya Formation') above the Longsight Sandstone. Processing of a sample from this core at 87.17 m (MFP 5864) yielded the following fossils:

Spores:
- Cyathidites spp.
- Gleicheniidites circinidites
- Neoraistrickia truncata

Lycopodiumsporites austroclavatidites

Reticulatisporites pudens

✓ Pilosisporites notensis (fragment)

Contignisporites cooksonae

Triletes BMR species no. 825

Microcachryidites antarcticus

Callialasporites dampieri

Alisporites similis & grandis

Vitreisporites pallidus

Podocarpidites ellipticus

Classopollis spp.

Other: Dingodinium cerviculum

Diconodinium multispinum

Chlamydophorella nyei

Hystrichosphaeridium sp.

Micrhystridium spp.

Veryhachium reductum

From the top of the argillaceous sequence (15-18 m depth) an additional cuttings sample was taken for analysis (MFP 5865). It yielded abundant microscopic plant debris, and (almost exclusively) a form with affinity to Palaeostomocystis sp., which was also recovered from the Longsight Sandstone. A few other forms, such as various Tasmanitids, Micrhystridium sp., and cf. Diconodinium multispinum, are also present.

Green et al. (1963) reported the first 50 feet (15 m) of the section as consisting of sandstone, and attributed it to the 'Wilgunya Formation'. Cuttings, which were available from this interval, were unsuitable for palynological examination, but from the lithology, and results of examination of the underlying sequence it is more probable that at least part of the sandstone interval represents the Cainozoic, rather than the Mesozoic.

The sample from the Longsight Sandstone may be contaminated by caving of higher parts of the well section during drilling. Aff. Palaeostomocystis sp. may be a secondary element from the higher part of the mudstone sequence. However, 'Gen. et sp. indet. A' Eisenack & Cookson is stratigraphically important, as it is only known to occur in strata associated with Neocomian-early Aptian palynological unit K1a (Murospora florida Zone; Burger, 1973). The microflora does not contain species characteristic of this unit, such as Murospora florida and Reticuloidosporites arcus, but the common presence of Reticulatisporites pudens is characteristic of the basal Cretaceous in Queensland. Therefore, I regard this assemblage as representing the uppermost part of unit K1a.

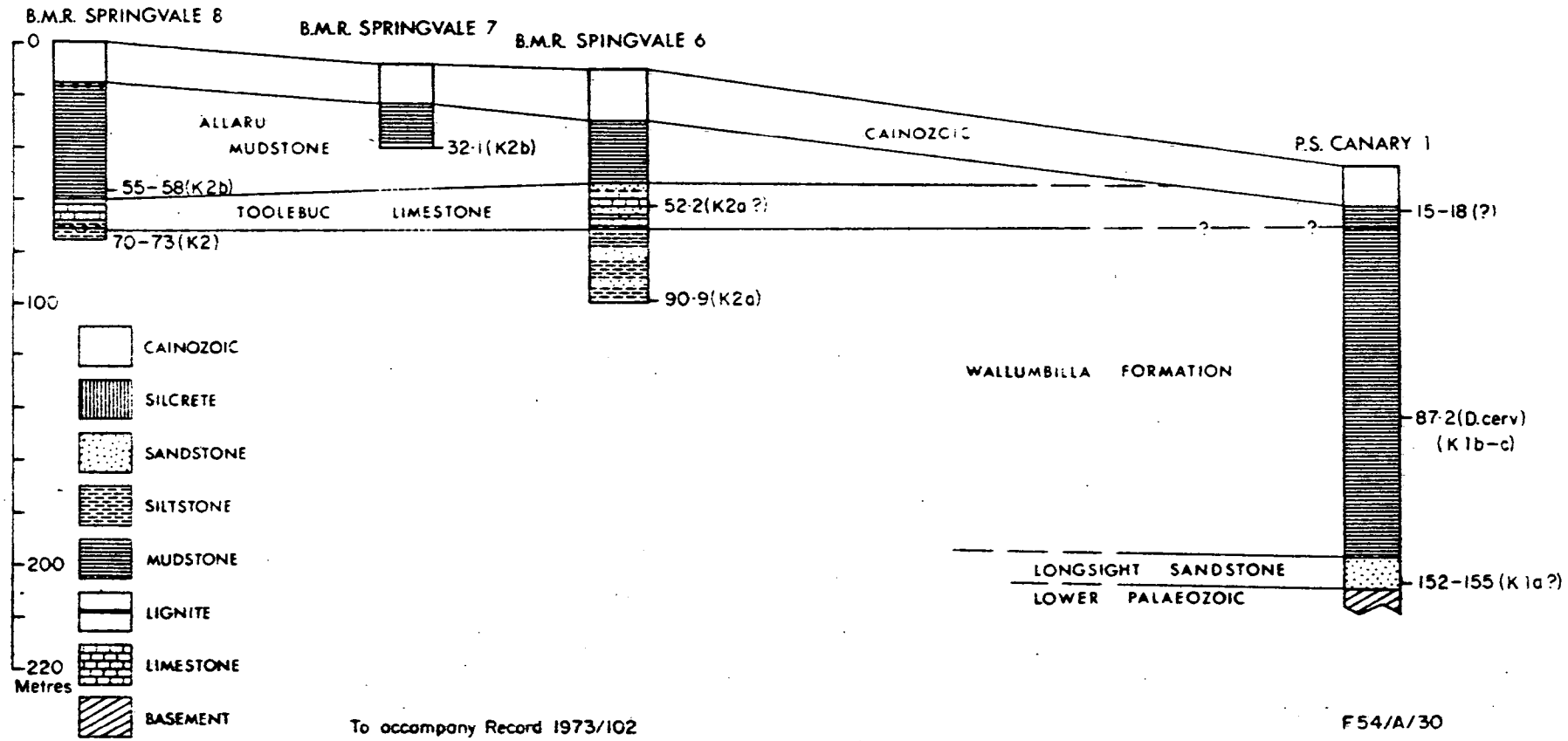
In Figure 2 the upper limit of the unit is at present located close to the base of the Wallumbilla Formation. In Conorada Ooroonoo 1 well, about 80 km to the east, this limit lies probably higher in the rock sequence (Burger, 1973), but it may not be so in the Springvale area, as the base of the Wallumbilla Formation in Queensland is probably time-transgressive. Further evidence must be awaited.

The assemblage from 87.17 m gives a fair indication of the stratigraphic position of the sample within the Wallumbilla Formation. The age of the fossils is distinctly Lower Cretaceous. Pilosisporites notensis is known from the late Neocomian, Aptian and Albian (Dettmann, 1963; Burger, 1973). Trilites BMR species no. 825 has been observed in the Neocomian and Aptian only. The microplankton assemblage represents the Aptian Dingodinium cerviculum Zone (Evans, 1966; Burger, 1968a,b). Dingodinium cerviculum occurs in Queensland in the (Aptian) Doncaster Member of the Wallumbilla Formation, and has been observed in slightly older strata in Queensland and Papua (Burger, 1973; pers. comm.). A few specimens of the species have also been found in the basal strata of the early Albian Coreena Member of the formation, but there is evidence that they are reworked. Diconodinium multispinum has not been observed in strata older than late Aptian (Burger, 1968a,b; 1969). Therefore it seems likely that the rock sample (core 1) is equivalent to the late Aptian Doncaster Member in the central and eastern Eromanga Basin. The spore assemblage probably represents unit K1b-c, which is closely associated in time with the Dingodinium cerviculum Zone.

The microfossils from the 15-18 m depth interval are undoubtedly of mid-Cretaceous age; the assemblage as such cannot be dated more precisely. It has been observed that microplankton assemblages recovered from the Toolebuc Limestone samples are commonly completely dominated

## STRATIGRAPHY AND PALYNOLOGICAL ZONATION, SPRINGVALE AREA, QUEENSLAND

FIGURE 2

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by one species; this may well reflect extreme conditions of salinity at that time. The lithological description of the well section does not directly confirm the presence of the Toolebuc Limestone, but the well was spudded in the outcrop area of the formation, and the gamma ray log registers high radioactivity between 40 and 70 feet (12 and 21 m). The sample may thus represent the Toolebuc Limestone in the well section; this is indicated in Figure 2.

The Lower Cretaceous was sampled in three shallow stratigraphic holes drilled in the southwestern part of the Sheet area. The upper part of the Wallumbilla Formation was sampled in BMR Springvale 6. Core 2 (depth 90.96 m; MFP 5853) yielded a diverse microfloral assemblage, in which the following species were recognized:

| | |
|---|---|
| Spores: | Cicatricosisporites australiensis |
| | C. hughesii |
| | C. pseudotripartitus |
| | Pilosisporites parvispinosus |
| | Cyclosporites hughesii |
| | Appendicisporites spp. (fragments) |
| | cf. Trilobosporites trioreticulosus |
| | Crybelosporites striatus |
| | Coptospora paradoxa |
| | Foraminisporis asymmetricus (common) |
| | Dictyotosporites complex |
| Other: | Chlamydophorella nyei |
| | cf. Palaeostomocystis fragilis |
| | Veryhachium reductum |
| | Microplankton indet. |

This spore assemblage is typical of palynological unit K2a. The absence of Microfoveolatosporis canaliculatus, which is common in assemblages from units K2a-c, suggests that the fossils represent the lowermost part of the unit.

A sample from cuttings from near the base of the Toolebuc Limestone in BMR Springvale 8 (70-73 m) yielded a moderately poor microflora, in which the following forms were identified:

Spores:
- Crybelosporites striatus
- Coptospora paradoxa
- Laevigatosporites ovatus
- Microfoveolatosporis canaliculatus
- Couperisporites tabulatus
- Appendicisporites sp. (contaminated?)
- Clavatipollenites hughesii

Other:
- Fromea amphora
- Oodnadattia tuberculata
- Cribroperidinium edwardsii
- Odontochitina operculata
- Hystrichosphaeridium spp.
- Chlamydophorella nyei (common)
- Diconodinium multispinum
- Pterodinium sp.
- aff. Palaeostomocystis sp.
- aff. Deflandrea sp.
- Veryhachium reductum
- Micrhystridium spp.

This assemblage is restricted to the interval of units K2a-b. The absence of distinct (tricolpate) angiospermous forms may point to a pre-unit K2b age for the spores, but the relatively poor recovery of palynomorphs, and the absence of Cyclosporites hughesii and Dictyotosporites speciosus, preclude positive dating of the assemblage.

The Toolebuc Limestone was extensively cored in BMR Springvale 6. Within an interval of 3 metres 5 samples were taken for palynological examination. Most samples yielded very few fossils which were poorly preserved. Rich microplankton assemblages and relatively well preserved spores were extracted from core 1 at 52.22 m (MFP 5860). The following forms were identified:

Spores:

Gleicheniidites circinidites

Cyathidites minor

Microfoveolatosporis canaliculatus (common)

Microcachryidites antarcticus

Alisporites grandis & similis

Podocarpidites ellipticus

Podosporites microsaccatus

Vitreisporites pallidus

cf. Tricolpites augathellaensis (1 specimen)

Clavatipollenites hughesii

Liliacidites trichotomosulcates

Other:

Odontochitina operculata

Diconodinium glabrum

D. multispinum (common)

Chlamydophorella nyei

Cyclonephelium membraniphorum

Hystrichosphaeridium sp.

Tasmanitids

Micrhystridium spp.

Veryhachium reductum

This assemblage is part of the interval of units K2a-b. L. trichotomosulcates was described by Singh (1971) from Albian sediments in Canada. It is not known from the Albian in the Great Artesian Basin, and it has not been found from the Cenomanian in Bathurst Island (Burger, in prep.). Neither has it been reported from elsewhere in Australia. Despite thorough scanning of the microscope preparations no other (tricolpate) angiospermous forms were found, except for one badly decayed specimen, cf. T. augathellaensis, a species known from the late Albian and Cenomanian of northern Australia. The assemblage probably lies in the vicinity of the boundary between units K2a and K2b, which is the level at which the first tricolpate angiospermous pollen appears in the sequence. This level is located in the eastern Eromanga and southern Carpentaria Basins in the basal strata of the Allaru Mudstone (Burger, 1968a; 1970; in prep.). The microflora is thus at present allocated to unit K2a.

The Allaru Mudstone was sampled in BMR Springvale 7 and 8. From the basal part of the formation in no. 8 hole, cuttings from 55-58 m depth produced a microflora (MFP 5867), in which the following zone-indicative forms are present:

Spore:

Cicatricosisporites hughesii

Gleicheniidites sp. nov.

Microfoveolatosporis canaliculatus

Laevigatosporites ovatus

Liliacidites trichotomosulcates

Cupuliferoidaepollenites sp.

Clavatipollenites hughesii

Other:

Diconodinium glabrum

D. multispinum

Ceratocystidiopsis ludbrookae

Cyclonephelium membraniphorum

Odontochitina operculata

Fromea amphora

Cribroperidinium edwardsii

Chlamydophorella nyei

Pterodinium sp.

Hystrichosphaeridium spp.

Micrhystridium spp.

Veryhachium reductum

There is no reason to assume that this microflora contains secondary (derived) elements. The presence of Cupuliferoidaepollenites sp. indicates that the microflora is younger than unit K2a, and the absence of species such as Appendicisporites distocarinatus, Clavifera triplex, and Hoegisporis uniforma indicates that the microflora probably represents an early interval within unit K2b.

From BMR Springvale 7, core 1, at 32.08 m a moderately diverse microflora (MFP 5856) was extracted; the following species were identified:

Spores:

Gleicheniidites sp. nov.

G. circinidites

Microfoveolatosporis canaliculatus

Laevigatosporites ovatus (common)

Hoegisporis uniforma

Clavatipollenites hughesii

Liliacidites trichotomosulcates

Cupuliferoidaepollenites sp.

Tricolpites augathellaensis

T. variabilis

Other:

Cyclonephelium membraniphorum

Odontochitina operculata

Fromea amphora

Diconodinium glabrum

D. multispinum

Goniaulacysta spp.

Pterodinium sp.

Hystrichosphaeridium spp.

cf. Deflandrea sp.

Veryhachium reductum

Pterospermopsis australiensis

Micrhystridium spp.

This assemblage is part of unit K2b. A drilling program in the Lower Cretaceous of the Boulia area, completed early in 1973, is expected to add valuable comparative/palynological information.

## HAY RIVER SHEET AREA

In the Hay River 1:250 000 Sheet area, Northern Territory, a sequence of sandstone, with minor siltstone and mudstone, overlain by thick mudstone occurs between the basement and thick Cainozoic deposits, which cover almost the entire area. This sequence was mapped as Cretaceous by Smith (1963). Palynological information was first obtained from examination of cuttings from 180 feet (54.9 m), at the base of the mudstone in No. 2 Bore G.L. 1843, drilled along the Plenty River (Fig. 3). Evans (in Crespin & Evans, 1962) gave the following list of plant microfossils extracted from the sample:

Spores:

- Cyathidites australis
- Gleicheniidites circinidites
- Baculatisporites comaumensis
- Apiculati spp.
- Trilobosporites trioreticulosus
- aff. Balmeisporites glenelgensis
- Pityosporites spp.
- Podocarpidites spp.
- Microcachryidites antarcticus
- Classopollis torosus
- Polypodiaceaeidites sp. nov.

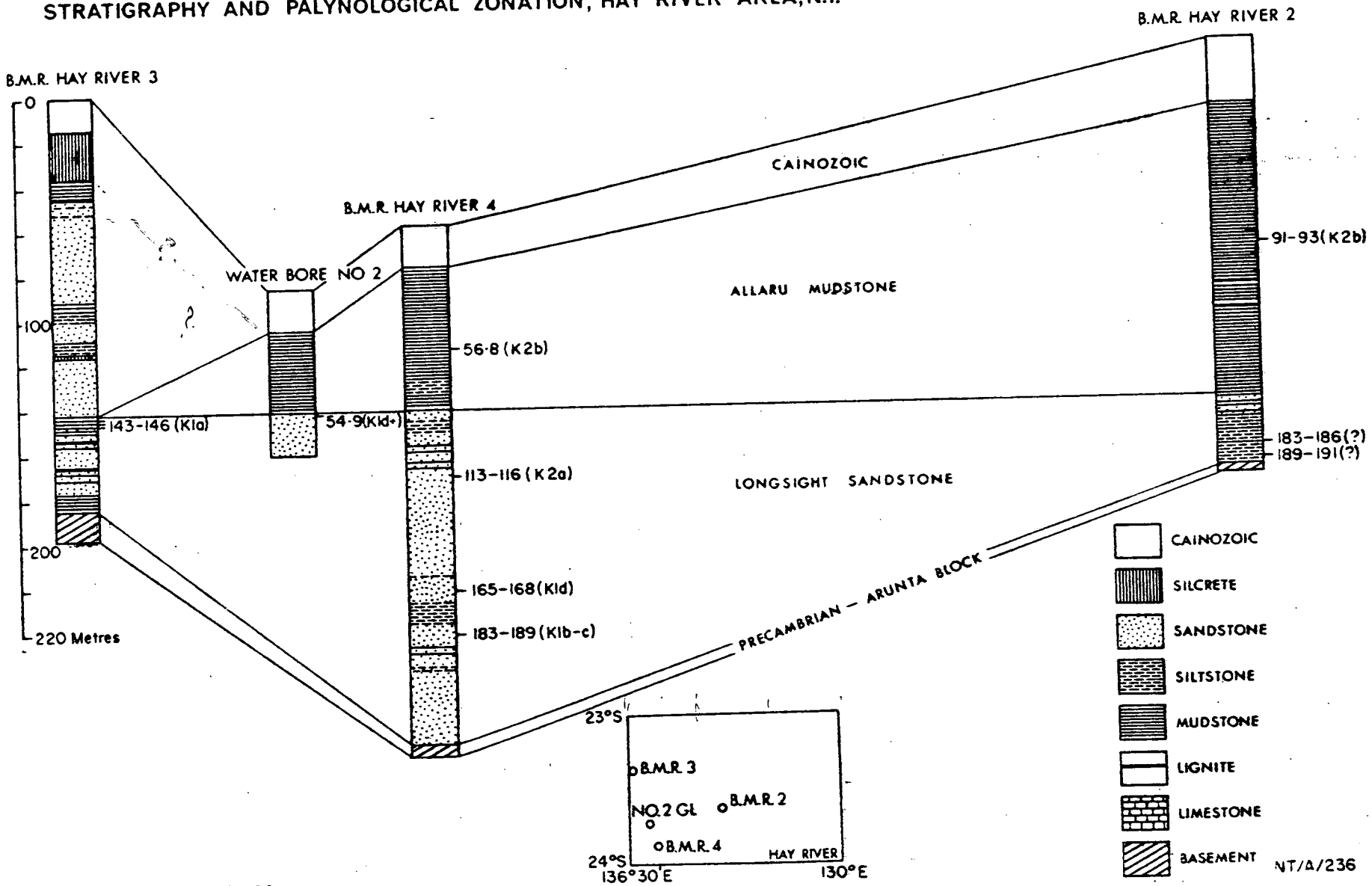
Other:

- Goniaylax spp.
- Diconodinium cf. D. glabrum
- Diconodinium sp.

This assemblage is typically Cretaceous and is in agreement with the occurrence of Lower Cretaceous foraminifera, which Crespin (Crespin & Evans, op. cit.) reported from the same sample. The list is insufficient for stratigraphic comparison of the assemblage with the spore-pollen sequence in the Great Artesian Basin in Queensland, but from the presence of T. trioreticulosus the microflora can be regarded as not older than palynological unit K1d (Albian); the species occurs sporadically in this unit, and becomes more common in units K2 (Albian) and K3 (Cenomanian). The assemblage could well be part of units K2, in view of

FIGURE 3

# STRATIGRAPHY AND PALYNOLOGICAL ZONATION, HAY RIVER AREA, N.T.

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the apparent absence of many species of angiospermous forms which Burger (in prep.) described from unit K3 in Bathurst Island, north of Darwin. Unfortunately, the material cannot be re-examined, as no strew mounts were preserved for the BMR palynological collection. Based on correlations with BMR Hay River Nos 2 and 4, the mudstone is regarded as part of the Lower Cretaceous (Albian) Allaru Mudstone.

Shallow stratigraphic drilling was carried out in the area from 18 June to 12 August 1971, in order to determine the thickness and extent of the Mesozoic and Cainozoic rocks, the nature of the basement, and to collect fresh material for palynological study. The results of the drilling were summarized by Yeates (1971). Four holes were drilled, ranging from 140 to 241 m depth. They intersected Cainozoic and Mesozoic rocks and were terminated in the Precambrian basement. Following the study of subsurface geology of the northwestern portion of the Eromanga Basin and palynological examination of cores and cuttings from all four bores, the stratigraphy of the Mesozoic rocks has been revised.

BMR Hay River 1 yielded no fossiliferous material. Cuttings of the light greenish grey mudstone from the 76-79 m depth interval, processed for palynological examination, were barren. The white calcareous mudstone from core 1 (111.2-112.7 m) was strongly weathered and unsuitable for palynology. The limestone from this core was also examined for microfossils, but the results were negative. Yeates (1971) interpreted the entire section above basement as undifferentiated Cainozoic. It is possible, however, that the mudstone sequence from 72 to 123 m is weathered Cretaceous, probably Allaru Mudstone.

BMR Hay River 3, core 1 (143-146 m), yielded the oldest microfloral assemblage so far described from the area. Three samples were taken for examination over an interval of 1.2 m. The oldest sample, that from 144.5 m, produced a microflora (MFP 5839), monotonous in composition, containing the following species:

Spores:

Stereisporites antiquasporites (abundant)

Cyathidites spp. (abundant)

Dictyophyllidites crenatus (abundant)

Gleicheniidites circinidites (abundant)

Biretisporites spectabilis

B. potoniaei

Cyathidites cf. C. punctatus

Osmundacidites wellmanii

Lycopodiumsporites austroclavatidites

L. rosewoodensis

Matonisporites cooksonae

Lycopodiacidites sp.

Dictyotosporites complex (common)

Microcachryidites antarcticus

Trisaccites microsaccatus

Alisporites similis

Podocarpidites ellipticus

Other: Schizosporis reticulatus

cf. Schizosporis parvus

Microplankton (unidentified remnants)

The next sample yielded a poorly preserved assemblage (MFP 5814), in which the following species are present:

Spores: Gleicheniidites circinidites

Cyathidites spp.

Stereisporites antiquasporites

Biretisporites spectabilis

Lycopodiumsporites sp.

Reticulatisporites pudens (common)

Microcachryidites antarcticus

Fragments of bisaccate types

Other: Odontochitina operculata

Plankton indeterm.

The highest sample, taken from 143.3 m, produced a moderately well preserved assemblage (MFP 5838), which contains the following species:

Spores:

Cyathidites minor

Biretisporites spectabilis

Dictyophyllidites crenatus

Stereisporites antiquasporites

Osmundacidites wellmanii

Lycopodiumsporites circolumenus

L. eminulus

Cicatricosisporites australiensis

Dictyotosporites complex

Crybelosporites stylosus

Densoisporites velatus (common)

Lycopodiacidites sp.

Contignisporites cooksonae

C. fornicatus

Inaperturopollenites cf. I. limbatus

Trisaccites microsaccatus

Microcachryidites antarcticus (common)

Alisporites similis

Podocarpidites ellipticus

On the basis of the presence of Cicatricosisporites australiensis, Densoisporites velatus, Crybelosporites stylosus, Microcachryidites antarcticus, Reticulatisporites pudens, and Contignisporites cooksonae, the assemblages can be dated without doubt as early Cretaceous. There is considerable diversity in the relative frequency of various species in the assemblages. The domination of a few forms in a microflora often complicates a precise age determination, as zone-indicative spores and pollen grains, which could be observed otherwise, may be obscured. Assemblage MFP 5838 may, from the presence of C. stylosus, represent palynological unit K1a, of Neocomian to early Aptian age (Burger, 1973). Assemblage MFP 5814 might likewise be of that age, as R. pudens has been found to occur more abundantly in unit K1a than in higher parts of the pollen sequence in the Great Artesian Basin. Other significant species by which the age of the microfloras could be narrowed down have not been recovered. For instance, Murospora florida, which would indicate unit K1a

was not found in either assemblage. The presence of O. operculata in sample MFP 5814 provides the only indication that this interval is not older than late Neocomian (Burger, 1973). I think, therefore, that the three microfloras, being of approximately the same age, may be taken as representing the uppermost part of unit K1a, or the immediately succeeding part of the sequence associated with the basal interval of unit K1b-c, of late Neocomian to early Aptian age.

The core sample is therefore comparable in age to the Longsight Sandstone in the Springvale area. This agrees with Yeates' (1971) view, that part of the section from 183 to 142 m in BMR Hay River 3 represents the Longsight Sandstone.

BMR Hay River 4 penetrated the thickest Mesozoic sequence and provided the most complete palynological information regionally. Although dating of the sandy sequence depended on material obtained from cuttings, it is in agreement with the results of surface mapping in the area.

In this section the mudstone overlies 30 m of sandstone and siltstone. Samples from sandstone cuttings at 183-189 m yielded a rich assemblage (MFP 5837, 5817), of which the most important species are:

Spores:

- Cyathidites punctatus
- Trilites cf. T. tuberculiformis
- Cicatricosisporites australiensis
- Reticulatisporites pudens
- Foraminisporis wonthaggiensis
- F. asymmetricus
- F. dailyi
- Sestrosporites pseudoalveolatus
- Densoisporites velatus (common)
- Perinate spore BMR species no. 825
- Classopollis simplex
- Microcachryidites antarcticus (common)
- Trisaccites microsaccatus
- Laevigatosporites ovatus (contaminant)

This microflora is of mid-Cretaceous age. The absence of Murospora florida, and the presence of BMR species 825 establish the fossils as representing the lower part of palynological unit K1b-c, of Aptian age. The microflora resembles that recovered from Hay River 3, core 1, by the presence of common D. velatus and M. antarcticus, but is very probably slightly younger, as it apparently lacks C. stylosus, and contains R. pudens in lesser abundance.

Microplankton was recovered in moderate abundance. The following species were identified:

Canningia colliveri

Chlamydophorella nyei

Diconodinium cf. D. glabrum

Diplotesta cf. D. glaessneri

aff. Deflandrea sp.

aff. Hystrichosphaeridium hirsutum

Pterodinium sp.

Spinidinium cf. S. styloniferum

Komewuia cf. K. glabra

Pterospermopsis aureolata

Veryhachium reductum

Micrhystridium spp.

The age of this assemblage cannot be determined accurately. Cookson & Eisenack (1958, 1962) described various species from the Lower Cretaceous in central and eastern Australia, but detailed accounts of the ranges of each species in Queensland have to await the results of forthcoming study of the Rolling Downs Group. The assemblage shows affinity to the Dingodinium cerviculum Dinoflagellate Zone of Evans (1966), but lacks the nominate species, which is widely distributed in the Aptian of Queensland.

Cuttings from 189-192 m depth yielded a fair number of microfossils, including late Albian to Cenomanian species, such as Microfoveolatosporis canaliculatus, Hoegisporis uniforma, Clavifera triplex, and Laevigatosporites ovatus. Considering the age of the previous sample, these species must be derived; the sample probably contained considerable amounts of rock chips from the upper part of the section. This is an example

of possible confusion, stemming from faulty age determination, which might not be recognized in instances where palynological control is insufficient.

A sample from cuttings of grey clayey sandstone at 165-168 m, about half-way in the sandy sequence, yielded a moderately well preserved spore-pollen assemblage (MFP 5836), in which the following types were encountered:

Spores:

Biretisporites potoniaei

Cyathidites puncatatus

Cicatricosisporites spp. (fragments)

Foraminisporis asymmetricus

Crybelosporites striatus

cf. C. punctatus

Microfoveolatosporis canaliculatus (contaminant)

Tricolpites sp. (contaminant)

Clavatipollenites hughesii (contaminant?)

Clavifera triplex (contaminant)

Other:

Chlamydophorella nyei

Cyclonephelium membraniphorum

Fromea amphora

aff. Hystrichosphaeridium hirsutum

Palaeostomocystis cf. P. fragilis

Pterodinium sp.

cf. Scriniodinium sp.

Schizosporis reticulatus

S. parvus

Veryhachium reductum

Micrhystridium spp.

The spore pollen assemblage contains single specimens of species which I regard as being derived from spore units K2a-b. This can be expected in dealing with cuttings. The absence of Coptospora paradoxa, Laevigatosporites ovatus, Trilobosporites trioreticulosus, and certain

other species characteristic of the interval of units K2a-b is an indication that the assemblage is older; this is confirmed by evidence from the upper part of the sandy sequence, discussed below. In view of the presence of C. striatus, and the common occurrence of F. asymmetricus, the assemblage may represent unit K1d, of early Albian age (Burger, 1968a; in press); this is in approximate agreement with the stratigraphic position of the fossils.

The microplankton assemblage does not contribute towards an age determination of the sample. Cookson & Eisenack (1962) reported C. membraniphorum from the Albian-Cenomanian of Western Australia, but the first occurrence of the species in the Great Artesian Basin is not well documented.

Cuttings of dark greyish green clayey sandstone from the upper part of the sandy sequence at 113-116 m yielded a microflora, rich in number of species (MFP 3835), and containing a fair number of microplankton. Among other species, the following are present:

Spores:

Cyathidites punctatus

Trilites cf. T. tuberculiformis

Cicatricosisporites australiensis

C. hughesii

C. pseudotripartitus

C. cf. C. ludbrookae

Pilosisporites grandis

Cyclosporites hughesii

Crybelosporites striatus

Trilobosporites trioreticulosus

T. purverulentus

Foraminisporis asymmetricus

F. wonthaggiensis

Densoisporites velatus

Gleicheniidites sp. nov.

Perotrilites cf. P. jubatus

P. spp.

Triporoletes simplex

Coptospora paradoxa

Laevigatosporites ovatus

Microfoveolatosporis canaliculatus

Clavatipollenites hughesii

Other: Cribroperidinium spp.

Chlamydophorella nyei

Diconodinium multispinum

D. glabrum

Fromea amphora

Horologinella sp.

aff. Hystrichosphaeridium hirsutum

Odontochitina operculata

Pterodinium sp.

Veryhachium reductum

The conspicuous absence of angiospermous (tricolpate) pollen types, which are so abundant in the overlying mudstone section (see below) indicates that the assemblage lies stratigraphically underneath the interval of unit K2b. This is confirmed by the presence of Cyclosporites hughesii, of which the upper limit of occurrence coincides with the first appearance of tricolpate forms in the palynological sequence of Queensland (Burger, 1970; in press). The assemblage is very likely part of unit K2a, of Albian age, as it contains C. paradoxa, M. canaliculatus, P. grandis, and C. pseudotripartitus.

The microplankton assemblage is Albian in character, but the ranges of individual species in the marine Cretaceous of central Australia are poorly known.

From approximately 25 m above the base of the mudstone, a sample of dark grey mudstone from core 2 at 56.8 m yielded well preserved spores, pollen grains and some microplankton. The assemblage includes the following significant zone-index species:

Spores:

Cicatricosisporites australiensis

C. hughesii

Crybelosporites striatus

Foraminisporis asymmetricus (common)

Densoisporites velatus

Trilobosporites trioreticulosus

Clavifera triplex

Microfoveolatosporis canaliculatus (common)

Laevigatosporites ovatus (common)

Coptospora paradoxa

Clavatipollenites hughesii (common)

Liliacidites peroreticulatus

Classopollis simplex

Tricolpites variabilis

T. augathellaensis

T. cf. T. micromunus

Cupuliferoidaepollenites sp.

Striatopollis cf. S. paraneus (1 specimen)

Other:

Palaeostomocystis cf. P. fragilis

aff. Hystrichosphaeridium sp.

Goniaulacysta/Cribroperidinium spp. (fragments)

Odontochitina operculata (fragments)

cf. Diconodinium sp.

Veryhachium reductum

Micrhystridium spp.

This assemblage is representative for unit K2b, in view of the occurrence of C. australiensis, C. paradoxa, M. canaliculatus, Crybelosporites striatus, and Tricolpites spp. Specimens of the (tricolpate) genus Striatopollis have so far not been observed in the marine sequence of the Great Artesian Basin; they are, however, common in the Cenomanian of Bathurst Island (Burger, in prep.). The presence of S. cf. S. paraneus in the present microflora might possibly be anomalous, as it has so far only been found in the Cenomanian of Bathurst Island, N.T.

Yeates (1961) interpreted the sandy sequence intersected in this hole as Longsight Sandstone, and the overlying dark grey mudstone as Wallumbilla Formation. Palynology bears this out only in part. The units to which assemblages recovered from the 189-113 m interval belong, have been associated with the Wallumbilla Formation in the Surat Basin (Burger, 1968b), the Eromanga Basin (Burger, 1968a) and the southern part of the Carpentaria Basin (Burger, in press). The microflora from core 2 in the mudstone sequence is identical to other microfloras recovered from the Allaru Mudstone in the Eromanga and Carpentaria Basins. The sandy sequence in the hole is lithologically comparable to the Longsight Sandstone, but is the palynological equivalent interval of the Wallumbilla Formation in central and southeastern Queensland. The overlying mudstone is both lithologically and palynologically equivalent to the Allaru Mudstone (Fig. 3).

The palynological succession indicates that there is no appreciable gap in the sequence of No. 4 hole; the Wallumbilla Formation apparently thins in a northwesterly direction and wedges out between the Springvale-Boulia area and the Hay River area, and is laterally replaced by the Longsight Sandstone (Fig. 4). This phenomenon is of more than local extent, as a similar sequence occurs in No. 2 hole (see below). Apparently, deposition became increasingly sandy towards the margin of the Eromanga Basin during the Aptian and early Albian.

No cores were cut from BMR Hay River 2, and spore information is derived solely from cuttings. In order to keep the possibility of recovering secondary (caved in) material at a minimum, a sample of dark grey mudstone was selected from the mudstone at 91-93 m, immediately underneath the deep weathering zone. The microfloral assemblage recovered was rich in species; the specimens were well preserved. The following age indicative species were identified:

Spores:

Cicatricosisporites spp.

Crybelosporites striatus

Microfoveolatosporis canaliculatus

Laevigatosporites ovatus

Coptospora paradoxa

Clavatipollenites hughesii

Hoegisporis uniforma

Classopollis simplex

Cupuliferoidaepollenites sp.

Tricolpites sp.

Liliacidites trichotomosulcates (1 specimen)

Other: Diconodinium multispinum

Diconodinium sp.

Chlamydophorella nyei

Cribroperidinium/Goniaulacysta (fragments)

Micrhystridium spp.

Veryhachium reductum

The assemblage does not contain conspicuously secondary elements and is definitely part of unit K2b.

Samples of cuttings from the interbedded siltstone and mudstone below the Allaru Mudstone, at 183-186 m and 189-191 m produced moderately rich and poorly preserved fossil assemblages. These contain many elements, including angiosperms, similar to those present in the previous sample.

It is possible that this part of the section represents a facies equivalent of the Allaru Mudstone; it is also possible that the fossils were derived from higher levels, so that the age of the assemblages does not match the stratigraphic position of the samples. At present we consider that the microfloras may be largely derived; no reliable age determination can be made under these circumstances. Yeates (1971) interpreted part of the section from 75 m down to basement (192 m) as the Wallumbilla Formation. On the basis of pollen recovery from 91-93 m it is more likely that the interval from 162.5 m to 51 m is part of the Allaru Mudstone. It is suggested that the part of the section above basement up to 162.5 m belongs to the Lower Cretaceous Longsight Sandstone (Fig. 3).

## REGIONAL STRATIGRAPHIC INTERPRETATION AND CONCLUSIONS

The basal Mesozoic rock sequence in the Western Eromanga Basin undergoes considerable lateral changes. Correlation of various rock units will be presented in detail together with the results of field work in the Simpson Desert. Some preliminary data are given in this report (Fig. 4).

To the south, in Amerada Hale River 1 well, the Jurassic to Lower Cretaceous sequence (J-K) can be subdivided into two units. The lower unit, consisting almost entirely of sandstone, is overlain by a sequence of calcareous sandstone interbedded with shale. These divisions correspond to the Algebuckina Sandstone and Cadna-Owie Formation of northwestern South Australia (Wopfner et al., 1970) and lower and upper Hooray Sandstone of southwestern Queensland respectively.

Towards the northern margin of the Eromanga Basin no comparable division is apparent (Fig. 4) and the ?Jurassic to Lower Cretaceous sequence was named the Longsight Sandstone (Casey, 1959). The name is derived from Longsight Peak on the Boulia Sheet area; the type area is at Longsight Peak (27°30'S, 139°32'E) and on the south side of Eastern Creek. It crops out in the Queensland portion of the northwestern part of the Eromanga Basin on the Duchess, Urandangi, Boulia, Glenormiston and Mount Whelan 1:250 000 Sheet areas.

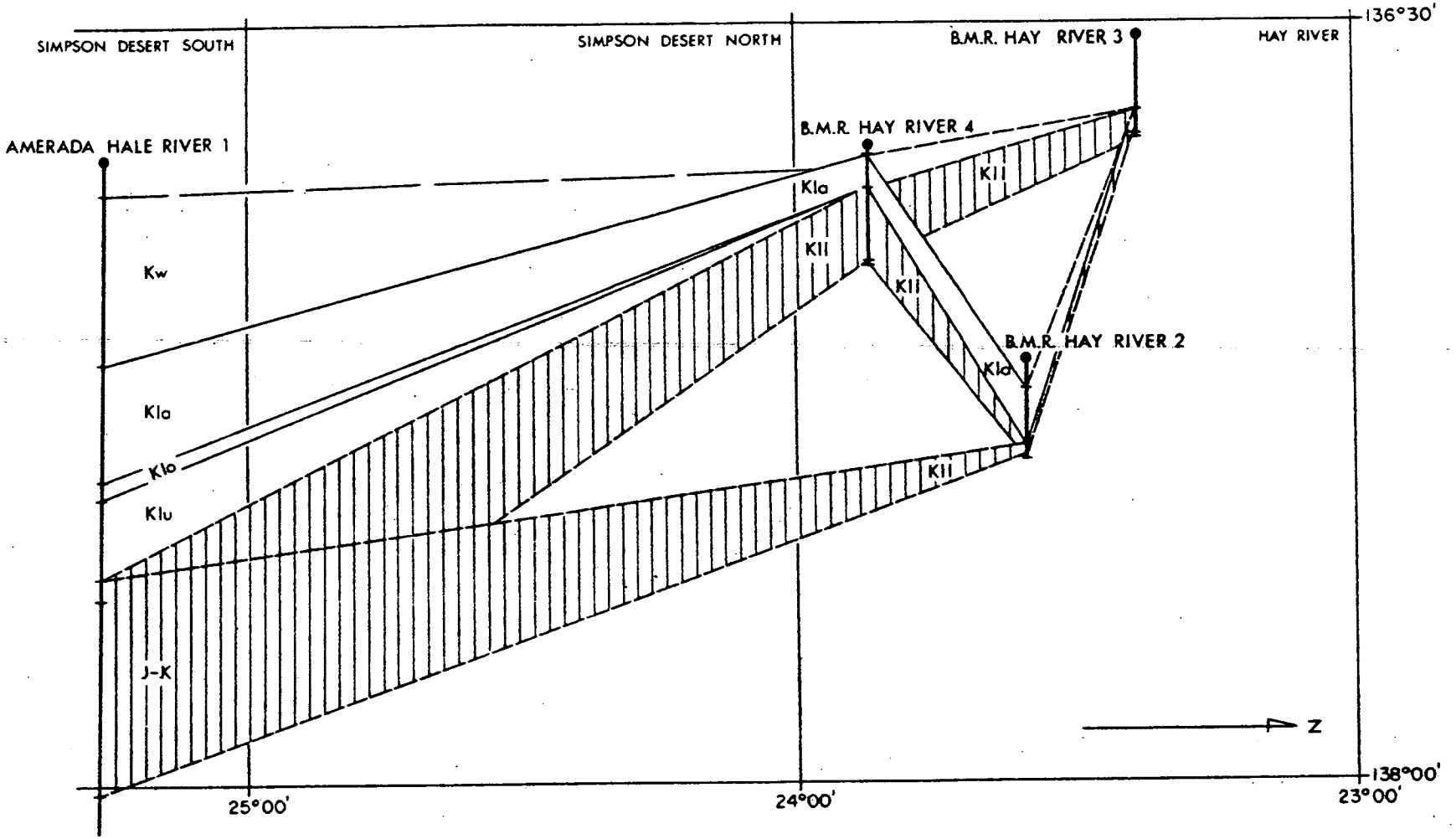
In the type area the Longsight Sandstone consists of very fine to medium-grained quartz sandstone, generally ferruginous and micaceous with some conglomerate and sandy siltstone. In the Mount Whelan Sheet area (Reynolds, 1968) the lower part of the sequence consists of silty sandstone with plant fossils and worm burrows, and the upper part of glauconitic sandstone with marine fossils. In BMR Hay River 4 (Yeates, 1971) it consists mainly of well sorted fine to medium-grained quartz sandstone with lesser amount of clayey sandstone, carbonaceous sandstone with a detrital dark mineral, calcareous sandstone, micaceous quartz sandstone, mudstone, and thin lignite seams. In places it is pyritic and ferruginous.

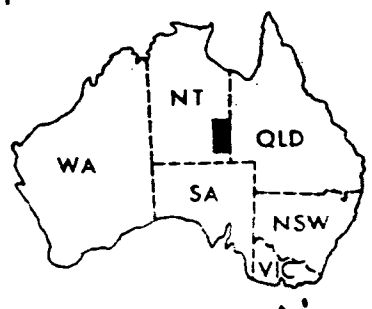
The Longsight Sandstone contains Lower Cretaceous foraminifera, macrofossils and plants in the type area (Casey, 1959). It rests unconformably on Precambrian and Lower Palaeozoic (Silurian-Devonian) and is conformably overlain by the Wallumbilla Formation. Palynological information discussed in this report shows that towards the northwestern margin of the Eromanga Basin the Wallumbilla Formation and Toolebuc Limestone pinch out (Fig. 4), and that in the Hay River Sheet area the Longsight Sandstone is ?conformably overlain by the Allaru Mudstone (Fig. 3).

The stratigraphic position of the Longsight Sandstone demonstrates that sandy deposition in the Hay River area continued longer than in the deeper parts of the basin. During the time of units K1d and K2a (Albian) deposition of sand extended over larger parts of the basin (Coreena and Ranmoor Members); this is connected with withdrawal of the sea (Burger, 1968b).

# UPPER MESOZOIC SEDIMENTS IN THE NORTHWESTERN EROMANGA BASIN

FIGURE 4




To accompany Record 1973/102

Kw Winton Formation
Kla Allaru Mudstone
Klo Toolebuc Limestone
Klu Wallumbilla Formation
Kll Longsight Sandstone
J-K Jurassic-Cretacous undiff.

0 20 40 60 Kilometres
0 20 40 Miles

NT/A/237

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