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Record No. 1968 / 125

Relationship of Palynology to Stratigraphy in the Lower Cretaceous of the Surat Basin in Queensland

by

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FOREWORD

This report is one in a series of B.M.R. Records dealing with the study of the history of fossil spores and pollen grains in the upper Mesozoic of the Great Artesian Basin, Queensland. The subject treated here is the history of microfloras in Aptian and Albian sediments of the western and central Surat Basin. Previous studies in the eastern Australian area have shown that identical successions of microfossil assemblages can be recognized in rock sequences from various environmental origins in geographically widely distributed depositional areas. The palynostratigraphy emerging from the present study is closely comparable with palynological zonations established from contemporaneous sequences elsewhere. It is therefore possible to correlate the sediments in the Surat Basin with these sequences in detail, on the basis of plant microfossils. In addition, the record of vertical and geographical distribution of marine microplankton gives a better insight into the paleogeography.

ABSTRACT

Core samples from shallow holes, drilled by the Bureau of Mineral Resources, gave opportunity for detailed investigation, on spores, pollen grains and microplankton, of the Cretaceous sediments overlying the Blythesdale Formation in the western and central part of the Surat Basin, Queensland. The drilled sections comprise the Doncaster and Coreena Members of the Wallumbilla Formation, and also younger strata, which until now have only been encountered in what is considered as the central part of the Basin, namely mudstone Klz and the overlying Griman Creek Beds.

The succession of microfloras compares closely with previous findings in the Eromanga Basin and other areas. Spore units K 1b-c, K 1d, K 2a and K 2b+ are identified. The distribution of these spore units in relation to the Cretaceous formations suggests rapidly shifting environments of deposition in the central part of the Basin. The picture of time/areal distribution of formations is not yet fully understood and requires more knowledge of surface geology and palynology in order to be satisfactorily explained.

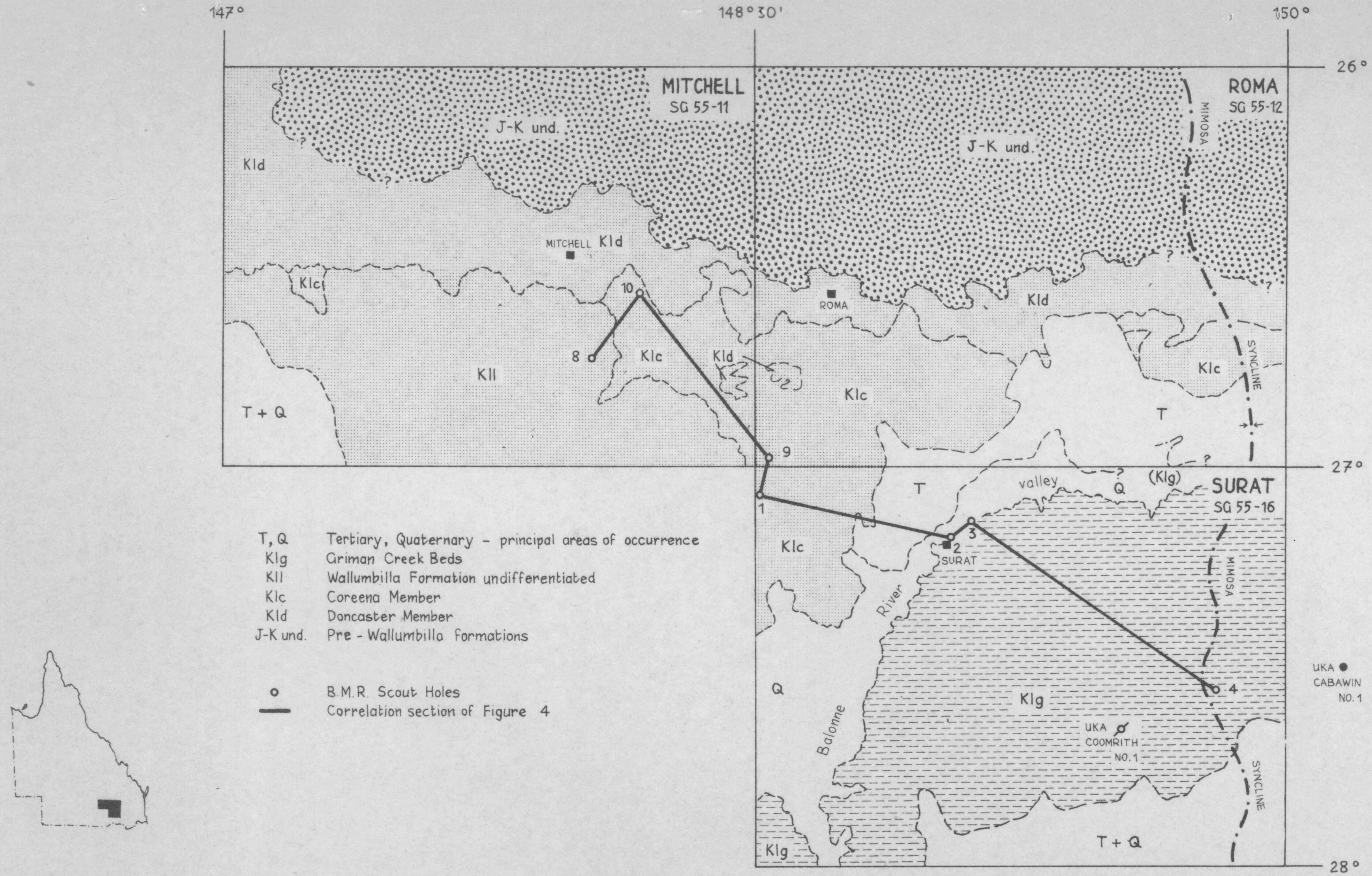

FIGURE 1 : GEOLOGY OF WESTERN SURAT BASIN AREA (SIMPLIFIED) AND LOCATIONS OF BOREHOLES

G55/A/37

To accompany Record 1968/125

INTRODUCTION

Geological mapping in the Mitchell Sheet area (Exon *et al.* 1966-b, 1967), Roma Sheet area (Exon *et al.* 1967) and Surat Sheet area (Thomas & Reiser 1968) disclosed a sequence of Jurassic and Cretaceous formations, of which some had been recognized from previous mapping in adjacent Sheet areas in the Eromanga Basin and subsequently traced in outcrop across the Nebine Ridge. The Cretaceous rock units are of both terrestrial and marine origin; the sediments of the Aptian-Albian interval discussed in this report, i.e. in stratigraphic succession the Wallumbilla Formation, Mudstone Klz and the Griman Creek Beds, present a picture of quiet deposition in a marginal zone during an initial transgression, followed by a period of increasingly terrestrial influence, locally interrupted by brief recurrence of (shallow) marine conditions.

STRATIGRAPHY

The surface geology of the Mitchell, Surat and Roma Sheet areas, as compiled from Exon *et al.* (1967) and Thomas & Reiser (1968) is depicted in Figure 1. For the sake of simplicity, much of the scattered occurrence of Tertiary and Quaternary in the southern parts of the Mitchell and Surat areas is not shown. Likewise, gentle folding and minor faulting that were mapped in the Mitchell and Roma areas are not marked; only the Mimosa Syncline is indicated, which is a broad, shallow structure associated with increased thickness of Jurassic and Cretaceous formations. The central axis is located near the eastern boundaries of the Roma and Surat areas and is oriented approximately to the south.

The Wallumbilla Formation, consisting of the earliest marine Cretaceous sediments and widely recognized in outcrop and subsurface of the Great Artesian Basin, occurs in outcrop in the western and northern parts of the Surat Basin, mainly south of the line Morven-Mitchell-Roma-Wallumbilla-North Dulacca. Two members were recognized. The basal Doncaster Member is principally a mudstone unit conformably overlying the Minmi Member of the Blythesdale Formation and with a thickness in subsurface of various oil wells between 300 and 400 feet (Exon et al. 1967), increasing to 550 feet in U.K.A. Coomrith No.1 (Thomas & Reiser 1968) and approximately 800 feet in U.K.A. Cabawin No.1 further to the east (Burger 1968-a; Thomas & Reiser op. cit.). From outcrop localities in the Mitchell and Roma Sheet areas Aptian molluscs were collected. Ostracods were recovered from the Member in B.M.R. Surat No.1 (core 5) and are thought to be of Lower to Middle Albian age (Jones in Thomas & Reiser op. cit.). Subsurface samples of the Member from B.M.R. Mitchell Nos 7 and 10 yielded marine microplankton. Hence the Member is regarded as from marine origin and most probably Aptian in age.

The overlying Coreena Member is predominantly silty, getting increasingly sandy towards the southeast, with a thickness of 250 feet in B.M.R. Mitchell No.10 (Exon et al. 1967; see also Figure 4), increasing to 700+ feet in the Arbroath Trough (A.A.O. Arbroath No.1 well; Exon et al. 1967), and approximately 700 feet in U.K.A. Cabawin No.1 (Burger 1968-a; Thomas & Reiser 1968). Cretaceous strata mapped as Coreena in the southern Roma Sheet area and consisting of sandstone and siltstone with various degrees of mudstone, have also been described from the northwestern part of the Surat Sheet area and were penetrated by B.M.R. Surat No.1. From outcrop localities in the Mitchell and Roma Sheet areas Lower Albian belemnites and pelecypods were collected. The Member was drilled in the Roma, Mitchell and Surat Sheet areas. Subsurface samples from the basal part of the Member in the Roma and Mitchell bores produced varying percentages of marine microplankton (Table 2), while samples from the higher part of the Member in B.M.R. Surat No. 1 did not show any trace of marine influence (Table 3). Foraminifera and ostracods in Surat No.1, core 5, indicate shallow marine deposition (Terpstra in Thomas & Reiser 1968).

In the southern part of the Mitchell Sheet area only a few outcrops are known, mainly of deeply weathered mudstones which are attributed to the Wallumbilla Formation and mapped as Wallumbilla undifferentiated (Exon et al. 1967).

In certain areas of the eastern Eromanga Basin the Coreena Member is conformably overlain by the Toolebuc Limestone, which has limited geographical distribution; elsewhere by the Allaru Mudstone (Exon et al. 1966-a; see also Figure 3). A different rock sequence was encountered in the Surat area, conformably overlying the Member. Two new units were recognized; notably an unnamed (mainly mudstone and siltstone) body, coded Klz, and the overlying Griman Creek Beds. Both units were distinctly identified in the E-logs of a number of oil wells drilled in the Surat area (Thomas & Reiser 1968).

Mudstone Klz was not traced in outcrop, as the Mesozoic geology is badly obscured by Cainozoic deposits, but is assumed to occur immediately beneath alluvial beds of the Balonne River valley. According to Thomas & Reiser, Klz appears in subsurface as a unit varying between 225 feet and 480 feet thick. It contains mudstone and glauconitic siltstone, in which plant remains were encountered. Almost total absence of marine microplankton in B.M.R. Surat Nos 2 and 3 (Table 3) points to conditions unfavourable of open marine life, while shell fragments and ostracods in Surat No.2, core 1, suggest shallow marine environments (Terpstra in Thomas & Reiser op. cit.).

The Griman Creek Beds are known in outcrop east and south of the Balonne River and cover about two-thirds of the Surat Sheet area. They appear in the E-logs of U.K.A. Coomrith No.1 as a body of 1000 feet thick. Thomas & Reiser assume that they are still thicker in the centre of the Mimosa Syncline. Few outcrop localities of fresh rock are known. Thomas & Reiser briefly discuss former records of fossils collected at or near Surat township, that were atttributed by various authors to Aptian or Lower Albian faunas. Fossils recently collected in the region of Surat and further southeast, in higher strata of the Beds, have not been studied in detail, but represent for a good deal not previously described forms. According to Day, a belemnite form collected near Surat might indicate an upper Doncaster to lower Coreena age for the strata, but reworking from beds to the north was not excluded. Fossils collected in the eastern part of the Sheet area "are almost certainly fresh water forms, reminiscent of the Winton faunas" (Thomas & Reiser 1968, p.28). None of the subsurface samples collected from the Beds (B.M.R. Surat Nos 3 and 4) yielded marine microplankton, while MFP 4628/34 and 4611 (Table 3) produced fragments of the freshwater alga Botryococcus.

The total of evidence points to (shallow) marine to brackish, near-coast surroundings in basal Coreena times, gradually changing to brackish-freshwater environments for the higher Coreena, Klz and basal Griman Creek Beds and ultimately to freshwater/terrestrial environments for the higher strata of the Beds.

SHALLOW DRILLING

Shallow holes were drilled in combination with field mapping by the Bureau of Mineral Resources and the Geological Survey of Queensland, in order to obtain information on subsurface lithology and palynology. Cores taken at more or less regular intervals in a number of drilled sections gave sufficient coverage of the formations in question for detailed palynology.

The bores selected for the present investigation are listed below, together with intervals of drilled formations and year of drilling.

MITCHELL NO.8 (1966) penetrated the Coreena Member from surface to 162 feet.

MITCHELL NO.10 (1966) was drilled through the Coreena Member from surface to 270 feet and the Doncaster Member to 401 feet.

ROMA NO.9 (1967) was drilled through the Coreena Member from 0 feet to about 200 feet and the Doncaster Member to 357 feet.

SURAT NO.1 (1967) penetrated the Coreena Member from surface to 429 feet.

SURAT NO.2 (1967) was started in the Griman Creek Beds and penetrated mudstone Klz from 70 feet to 135½ feet.

TABLE 1 : COMPARISON BETWEEN LITHOLOGY AND SPORE ZONATION

BMR Scout Hole	Core	Sample number (MFP)	Depth	Lithology	Spore units	Micro-plankton
Surat No. 4	1	4634	93'3"	Griman Ck. Beds	K 2b+	
	1	4628	94'1"	,	,	
	2	4635	195'11"	,	,	
	3	4636	302'11"	,	K 2a	
Surat No. 3	1	4611	52'3"	Griman Ck. Beds	K 2b+	(*)
	2	4612	161'3"	Klz	,	*
	3	4623	246'5"	,	K 2a	*
	4	4624	350'	,	K 1d	*
	5	4625	452'4"	,	,	*
Surat No. 2	cutt	4671	100-110'	Klz	K 2a	*
	1	4535	135'5"	,	,	*
Surat No. 1	3	4536	139'1"	Coreena	K 2a	?
	4	4537	213'2"	,	,	
	5	4538	428'2"	,	K 1d	
Roma No. 9	1	4615	100'2"	Coreena	K 1d	*
	2	4616	200'1"	,	K 1d	*
	3	4627	260'	Doncaster	K	*
	4	4638	354'8"	,	K 1b-c	(*)
Mitchell No. 10	4	4255	83'6"	Coreena	K 1d	*
	5	4256	150'	,	,	*
	5	4257	159'	,	,	
	6	4250	272'	Doncaster	K 1b-c	*
	6	4251	281'	,	,	*
	7	4252	392'	,	,	*
Mitchell No. 8	1	4242	60'	Coreena	K 1d	*
	2	4243	68'4"	,	,	*
	3	4244	86'10"	,	,	*
	4	4245	152'	,	,	*

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SURAT NO.3 (1967) penetrated the Griman Creek Beds down to 70 feet and mudstone Klz to 462 feet.

SURAT NO.4 (1967) penetrated the Griman Creek Beds from surface to 303 feet.

The Mitchell bores, initially treated palynologically by Burger (in Exon et al. 1967) were later slightly revised (Burger 1968-b); they are included in the present report with more details, as they represent, together with Roma No.9, a valuable palynological link between the sequence of the Wallumbilla Formation in the eastern Eromanga Basin (Tambo-Longreach area) and that in the Surat Basin. Surat Nos 1 to 4 give a cross-section of the strata overlying the Formation at the southern Roma Shelf and in the central part of the Mimosa Syncline. The bore locations are marked in Figure 1; the profile along the line that connects the bores from Mitchell No.10 to Surat No.4 is approximately normal to the assumed strike direction of the sediments.

The drilled sections, as depicted in the correlation diagram of Figure 4 show the intervals in which the formations are identified and the stratigraphic positions of the samples selected for palynological investigation. The samples are marked by their B.M.R. sample catalogue number (MFP). Depth below surface, lithology and palynological age of the samples are summarized in Table 1.

PALYNOLOGY

Introduction

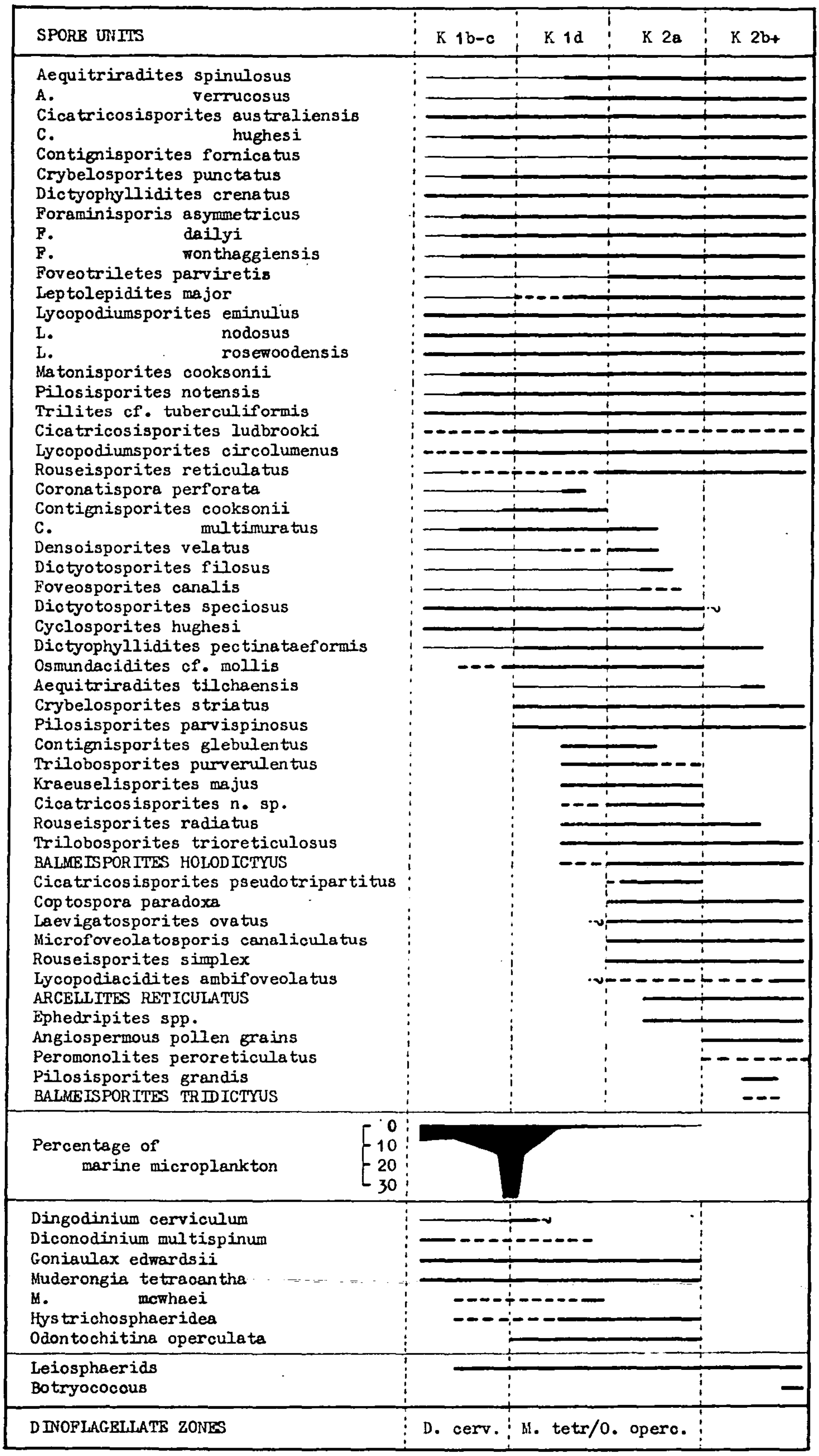
A selection of samples from the Mitchell, Roma and Surat Scout holes, investigated on spores and listed in Table 1 are represented in the microfossil distribution charts of Tables 2 and 3. A generalized vertical distribution diagram of sporomorphs and microplankton, compiled from these Tables is represented in Figure 2. The palynological age of each sample is given in Table 1 and in Figure 4.

The list of pollen and spore species includes forms that were recorded from the northern and eastern Eromanga Basin (Burger 1968-b) and is extended with a number of species that are considered to have stratigraphic importance, as they appear to have limited vertical distribution in southeastern Australia (Dettmann 1963). The new observations from the Surat Basin area add considerably to the knowledge of time distribution of spores in the Great Artesian Basin, by correcting earlier erroneous assumptions on first and last occurrence, drawn from insufficient sampling. Spore and microplankton information from U.K.A. Coomrith and U.K.A. Cabawin Nos 1 are also taken into account, as they penetrate the Cretaceous sequence close to the central axis of the Mimosa Syncline (Figure 1), extending lateral control of the Cretaceous spore units further east into the Basin.

Palynological units

Comparison of vertical distribution of microfossils in the Surat Basin (see Figure 2) with the spore history in the Aptian and Albian of the Eromanga Basin (Burger 1968-b) reveals a number of identical points. Horizons of first and last appearance of index microfossils emerge in identical succession, enclosing portions of the spore sequence which are similar to Evans' Lower Createaceous spore units. The stratigraphic intervals taken by the units in every drilled section are indicated in Figure 4; the original concepts of the spore units are summarized in Evans (1966-a) and discussed in this report in the light of more recent spore data.

FIGURE 2 : TIME DISTRIBUTION OF SELECTED MICROFOSSILS IN THE UPPER LOWER CRETACEOUS, SURAT BASIN, QUEENSLAND



Vertical distribution observed

Extension of vertical ranges in the sampled interval, Surat Basin, known from previous studies.

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In spite of scarce occurrence of microplankton, Evans' Lower Cretaceous Dinoflagellate Zones could be recognized. Time relationship between spore units and microplankton zones appears to agree approximately with previous observations from the Otway Basin and Great Artesian Basin (Evans 1966-a,b,d) and is discussed on pages 17 and 18.

Units K 1b-c

Evans (1966-a) characterized K 1b-c microfloras as belonging to the Cretaceous interval between the last occurrence of Murospora florida and the first appearance of Crybelosporites striatus. Spores typical of this interval are Cyclosporites hughesi, Dictyotosporites speciosus, Cicatricosisporites australiensis, Pilosisporites notensis. Although much detailed study has been carried out on these units in Queensland recently, it has not been possible so far to come to a better definition of K 1b-c on the ground of more positive spore data.

Study of minutely sampled successions of microfloras at the contact between units K 1a and K 1b-c in the uppermost Blythesdale Formation, Surat Basin, suggests that the first appearance of Pilosisporites notensis coincides approximately with the last occurrence of Murospora florida, which agrees with Dettmann(1963). One instance is known (B.M.R. Mitchell No.7 bore) where the ranges of both species overlap. P. notensis is widely known from younger assemblages in eastern Australia.

Spore types such as Crybelosporites punctatus, Densoisporites velatus, Matonisporites cooksonii, that according to Dettmann appear simultaneously with P. notensis are too scarce in the Cretaceous of the Surat and Eromanga Basins to be useful for stratigraphic purposes. In higher levels of unit K 1b-c Osmundacidites cf. mollis appears, the stratigraphic value of which is still uncertain.

Unit K 1b-c was recognized in the Doncaster Member of Mitchell No.10 (cores 6 and 7) and Roma No.9 (core 4). Microfossils are generally well preserved. Common spores are:

Cicatricosisporites australiensis, Lycopodiumsporites eminulus, Pilosisporites notensis. Less abundant but persistent types are Dictyotosporites speciosus, Cyclosporites hughesi, Classopollis spp., Dictyophyllidites crenatus, Contignisporites multimuratus. The following spores were only occasionally found: Dictyotosporites complex, Trilites cf. tuberculiformis, Lycopodiumsporites nodosus, L. circolumenus, Cicatricosisporites hughesi, Foraminisporis asymmetricus, F. wonthaggiensis, Osmundacidites cf. mollis, Cicatricosisporites ludbrooki.

From Roma No.9, core 3, a very poorly preserved microflora was recovered, in which Cicatricosisporites australiensis was recognized.

The assemblages closely resemble those studied from the Doncaster Member in U.K.A. Cabawin No.1 (Burger 1968-a) from the same Member in various localities of the Eromanga Basin and also from the Jones Valley Member in the Richmond area; they form the palynological equivalent of the middle Speciosus Assemblage (Dettmann 1963).

Unit K 1d

Evans characterizes K 1d microfloras by the occurrence of Crybelosporites striatus, prior to the first appearance of Coptospora paradoxa. C. striatus is well known from the Wallumbilla ("Lower Wilgunya") Formation and its earliest occurrence was reported from the lowermost Ranmoor Member in the Richmond area (Burger 1968-b). Evans (1966-a) reported the spore from "post-Roma" horizons in the Surat Basin, which are regarded as the Coreena Member of the Wallumbilla Formation.

Unit K 1d was identified in microfloras from the Member in Mitchell No.8 (cores 1 to 4), Mitchell No.10 (cores 4 and 5), Roma No.9 (cores 1 and 2), Surat No.1 (core 5); also in mudstone Klz in Surat No.3 (cores 4 and 5).

In U.K.A. Coomrith No.1, of which the relevant section is represented here, three samples from cuttings, taken from the

Coreena Member, mudstone Klz and the Griman Creek Beds, also produced K ld microfloras (Burger in Thomas & Reiser 1968).

STRATIGRAPHY		MFP	DEPTH	UNIT	MICRO-PLANKTON
	Klg				
		4631	900- 910 ft		?
1000'					
	Klz	4632	1100-1110 "	K ld	M. tetr/ O. operc.
1310'					
		4633	1480-1490 "		
	Klc				
1630'					

Common among the selected spores are: Cicatricosisporites australiensis, Crybelosporites striatus, while less common but persistent types are: Pilosisporites parvispinosus, Cyclosporites hughesi, Dictyophyllidites crenatus, Foraminisporis asymmetricus, Lycopodiumsporites rosewoodensis, Contignisporites multimuratus, Dictyotosporites speciosus, D. complex. Spores that only occasionally appear are among others: Pilosisporites notensis, Lycopodiumsporites nodosus, L. circolumenus, Densoisporites velatus, Cicatricosisporites ludbrooki, Trilites cf. tuberculiformis, Foveotriletes parviretis, Foraminisporis dailyi, F. wonthaggiensis, Crybelosporites punctatus, Balmeisporites holodictyus, Osmundacidites cf. mollis, Laevigatosporites ovatus.

The essential difference with the preceding assemblages is the simultaneous appearance of C. striatus and P. parvispinosus. Dettmann reports both spores from the upper Speciosus Assemblage in southeastern Australia. In agreement with this, P. parvispinosus appears also at the same level as C. striatus in B.M.R. Richmond No.1 bore, northern Eromanga Basin (Burger 1968-b).

Although Laevigatosporites ovatus regularly occurs together with Coptospora paradoxa, and Dettmann does not mention the spore from the Speciosus Assemblage, it has been encountered in K 1d microfloras from the Eromanga Basin on a few occasions; it occurs also in Mitchell No.8, core 1 (Table 2). Microfoveolatosporis canaliculatus has until now been reported only in association with Coptospora paradoxa (Dettmann 1963; Burger 1968-b). Its occurrence in Mitchell No.8, core 2, suggests a slightly downwards extension of the vertical range into unit K 1d. The base of the succeeding unit K 2a, indicated by the first appearance of Coptospora paradoxa, lies probably not much higher in the section of this bore.

Three other spore types appear in earlier levels than former observations suggested. Rouseisporites radiatus was until this moment only known from the Paradoxa Assemblage (Dettmann 1963) and in K2 microfloras (Burger 1968-b) of the eastern Australian region, i.e. in association with Coptospora paradoxa. It was also encountered in the interval of unit K 1d (Surat No.1 core 5; Surat No.3, core 4). Similarly, Kraeuselisporites majus occurs in the K 1d microflora of Mitchell No.10, core 5 (Table 2). Trilobosporites trioreticulosus was encountered in the interval of unit K 1d, Surat No.3, cores 4 and 5, and also in the K 1d microfloras from U.K.A. Coomrith No.1.

Another spore, provisionally assigned to Lycopodiacidites ambifoveolatus Brenner 1963 was reported as a rare constituent in K 2 microfloras in the Eromanga Basin (Burger 1968-b); in the Surat Basin it also appeared in the K 1d interval of Surat No.3 (core 4).

Information from the Great Artesian Basin until the present time suggests that the lower boundary of unit K 1d coincides approximately with the base of the Coreena Member across large distances. C. striatus not only appears close to the base of the Ranmoer Member, the northern equivalent of the Coreena (B.M.R. Richmond No. 1; Burger 1968-b), but also near the base of the Coreena in the Mitchell-Roma area, as indicated by the dated cores in Roma No.9 and Mitchell No.10, and even further to the east, across the Mimosa

Syncline in the section of U.K.A. Cabawin No.1 (Burger 1968a; Thomas & Reiser 1968, Appendix 6). The spore was also recovered from the lower Coreena in U.K.A. Coomrith No.1 (MFP 4633) and from what Thomas & Reiser consider as the basal Coreena in Surat No.1 (MFP 4538).

No instance is known of K 1d microfloras having been recovered from the Doncaster Member in the Great Artesian Basin, while in various instances K 1b-c microfloras were recovered from higher Doncaster horizons in Mitchell No.10 (this report), B.M.R. Roma No.8 (not published), even from the basal Ranmoor in the Richmond area (Burger 1968-b).

Further investigation is being carried out on the stratigraphic position of unit K 1d in relation to the interval of the Coreena/Ranmoor Member in subsurface sections from the central and western Eromanga Basin. It is the author's opinion that parallel relationship might exist throughout the province of the Member; it is expected that future drilling for commercial purposes in the Eromanga Basin will provide additional information on the matter.

Unit K 2a

Evans (1966-b) defined K 2a microfloras as occurring in the interval between the first appearance of Coptospora paradoxa and the last occurrence of Dictyotosporites speciosus. As such they represent the equivalent of the basal interval of Dettmann's Paradoxa Assemblage (Dettmann 1963, Penola Bore No.1, Otway Basin) in the Lower Cretaceous of the Eromanga Basin. As unit K 2a forms a very narrow interval within the spore sequence, there are only few records of the co-occurrence of the index spores from the Queensland area.

Evans encountered post-K 1 assemblages from strata overlying the Toolebuc Limestone in the central Eromanga Basin (Evans 1966-c). Burger (1968-b) recorded C. paradoxa from as early as the upper part of the Coreena Member (Longreach area), accompanied by Cicatricosisporites pseudotripartitus, Trilobosporites trioreticulosus, T. tribotrys, which are only known from Paradoxa/K 2 microfloras. Dictyotosporites speciosus may occur as high as the boundary between the Allaru Mudstone and the correlate of the Toolebuc Limestone in B.M.R. Tambo No.6 (MFP 4379). Initially, Burger (1968-b) designated the lower part of the K 2 interval in the Eromanga Basin area as Division A-1, separating it from the succeeding Division A-2, in which interval certain tricolpate pollen grains appeared (B.M.R. species collection nos. 802 and 816). The interval of A-1 appeared to be restricted to the upper Coreena and probably also the Toolebuc Limestone correlate in the eastern part of the Basin; correlation with unit K 2a was tentative.

Until recently, Cretaceous sediments mapped in the Surat Basin were only known to produce K 1 microfloras. Shallow drilling in recently mapped strata from the central part of the Basin also proved the existence of sediments of K 2 age.

In all four Surat bores the spore sequence shows an interval in which Coptospora paradoxa occurs before certain tricolpate pollen grains are introduced (Table 3). This interval coincides with Division A-1 and was recognized in the Coreena Member of Surat No.1 (cores 3 and 4), also in mudstone Klz of Surat No.2 (core 1, cuttings at 100 feet) and Surat No.3 (core 3), as well as in the Griman Creek Beds of Surat No.4 (core 3). The co-occurrence of C. paradoxa and D. speciosus in Surat No.2 (core 1), Surat No.3 (core 2) and Surat No.4 (core 3) justifies identification of the Division with spore unit K 2a and confirms Burger's initial tentative correlation. Relationship of Divisions and spore units appears to be as follows:

DIVISIONS (Burger 1968-b)	SPORE UNITS
A-2 +	K 2b +
A-1	K 2a

The microflora of Surat No.3, core 2, which contains D. speciosus as well as tricolpate pollen grains typical of Division A-2, is considered to represent the contact between units K 2a and K 2b.

So far, D. speciosus has not been reported from younger (i.e. post-Division A-1) assemblages. One rather distorted specimen in the microflora of Surat No.3, core 1, tentatively assigned to the species, has the appearance of being recycled and foreign to the rest of the assemblage. Nevertheless, the author does not exclude the possibility of recovering this type from younger assemblages in future research. At the present time unit K 2a is characterized as occurring in the interval formed by the overlap of the vertical range of C. paradoxa and D. speciosus, according to Evans (1966-b), while succeeding unit K 2b commences with the first appearance of pollen species B.M.R. 802 and 816.

Common spores in the K 2a microfloras are Cicatricosisporites australiensis, Crybelosporite striatus. The following spores are found equally persistent, although in lesser quantities: Coptospora paradoxa, Trilobosporites trioreticulosus, Cyclosporites hughesi, Foraminisporis asymmetricus, Dictyotosporites speciosus, Lycopodiumsporites nodosus; while a number of types were only occasionally found, such as Pilosisporites notensis, Contignisporites spp., Aequitriradites tilchaensis, Cicatricosisporites ludbrooki, Ephedripites sp., Foraminisporis dailyi, Laevigatosporites ovatus, Trilobosporites purverulentus.

In Surat No.2, MFP 4671 (cuttings from 100 feet) one single specimen of species B.M.R. 802 occurs in an otherwise well preserved assemblage that contains Dictyotosporites speciosus, Cyclosporites hughesi, Laevigatosporites ovatus, Cicatricosisporites pseudotripartitus. This microflora is very closely comparable to the basal K 2 assemblage described from elsewhere, its age is considered as K 2a, and the presence of B.M.R. 802 is, from its decayed appearance, regarded as contaminated from higher levels in the drilled section. Its presence, however, indicates that K 2b sediments occur in the section above 100 feet (Figure 4).

One type of tricolpate, smooth-walled pollen grain (B.M.R. species 803) has previously been found already in K 1b-c microfloras. It was also recovered from the K 1b-c interval in Mitchell No.10 and from the K 2a interval in Surat No.1.

Assemblages of K 2a age appear to be closely comparable in the eastern Eromanga Basin and the Surat Basin. The overlap of the vertical ranges of C. paradoxa and D. speciosus is more distinct in the Surat bores, as well as that of C. paradoxa and Cyclosporites hughesi, which was already apparent from the Eromanga Basin and may form a valuable additional criterium in identifying unit K 2a.

The last occurrence of Osmundacidites cf. mollis appears to lie at a younger level than earlier reports suggested, and seems to coincide with that of C. hughesi and D. speciosus. Ephedripites first appears in the interval of K 2a in Surat No.2 (MFP 4535) which is earlier than noticed in the Longreach and Tambo areas. This type does not occur in sufficient frequency and is therefore not considered as a satisfactory index fossil.

Units K 2b+

Microfloras immediately succeeding unit K 2a/Division A-1 have been found to contain minor proportions of tricolpate pollen grains, that appear persistently in post-Toolebuc formations, studied from various localities in the Eromanga Basin (Burger, in prep.). Identical pollen grains were also recovered from horizons overlying the K 2a interval in the central Surat Basin, drilled in the Surat bores and some deep wells further south.

Surat No.3, cores 1 and 2, and Surat No.4, cores 1 and 2 yielded comparatively uniform assemblages in which the proportion of angiosperms was below 1%. The most common among the recognized spore types are: Cicatricosisporites australiensis, Crybelosporites striatus, Foraminisporis asymmetricus, Lycopodiumsporites eminulus. The following species were recognized in every sample, although in lesser quantities: Balmeisporites holodictyus, Cicatricosisporites hughesi, Crybelosporites punctatus, Dictyophyllidites crenatus, Foraminisporis dailyi, Laevigatosporites ovatus, Trilobosporites trioreticulosus. Spore types occurring in low sample frequency are among others: Aequitriradites verrucosus, Cicatricosisporites n. sp. (B.M.R. no.807), Kraeuselisporites majus, Lycopodiumsporites circolumenus, Matonisporites cooksonii, Microfoveolatosporis canaliculatus, Pilosisporites grandis.

Burger attempted to distinguish, in the interval of the K-2b+ microfloras of the Longreach area an earlier mentioned lower Division A-2, comprising a large part of the Allaru Mudstone and characterized by the first appearance of tricolpate pollen grains together with Plicatella spp., in combination with the last occurrence of Contignisporites multimuratus, Dictyophyllidites crenatus, Lycopodiumsporites eminulus and L. rosewoodensis. An upper Division B was distinguished by the first appearance of Ephedripites sp. and an increasing proportion of angiosperms in the assemblages. The associated strata belonged to the uppermost Allaru Mudstone and the lower part of the Mackunda Formation (Burger 1968-b).

Comparison of the K 2b+ interval in the Surat bores with Divisions A-2 and B leads to the following observations:

(1) In the Longreach area the following spore species: Lycopodiumsporites rosewoodensis, Leptolepidites major and Pilosisporites notensis were recovered from Division A-2 microfloras in the Allaru Mudstone. P. notensis and L. major also occurred in microfloras from Division B in the basal Mackunda Formation, which is probably close to their point of last occurrence, as neither of them has been recovered from the overlying Winton Formation in the central and northern Eromanga Basin. Brief mention was also made of the occurrence of new spore types in the basal Mackunda Formation, possibly assignable to Taurocusporites Stover 1962 and Stereisporites Thomson & Pflug 1953. The absence of these types, coupled with the presence of the three types mentioned above, particularly L. rosewoodensis in the K 2b+ microfloras of the Surat area indicates that this interval has more elements in common with Division A-2 than with Division B.

(2) From study of the occurrence of angiosperms in the Cretaceous of Queensland, moderate percentages of B.M.R. species 803 in the Allaru Mudstone were noticed, in comparison with other angiospermous types. In microfloras from the Winton Formation

proportions of angiosperms varied from 1.5% (W.O.L. Warbreccan wells) to 9% (B.M.R. Augathella No.4 Scout). Species no.803 was invariably the most dominant form, while other types remained relatively scarce. The picture observed in the microfloras from the Surat bores shows amounts of B.M.R. 803 comparable to other types within the fractions of angiosperms. The microfloras from the Allaru Mudstone, as well as from the Griman Creek Beds contained less than 1% of angiosperms, while in the Mackunda Formation of the Longreach area fractions of 5% occurred. Angiosperms from the Winton Formation included certain forms that have not been found in older microfloras either from the Eromanga Basin or from the Surat area. It is reasonable to assume from these points, although the study of angiosperms in Queensland is in a little advanced stage, that the assemblages from the Griman Creek Beds are older than those from the Winton Formation in the central and eastern Eromanga Basin.

The evidence from (1) and (2), together with general resemblance of microfloras appears to be in favour of correlating the K 2b microfloras from the Surat bores with approximately Division A-2. The associated horizons in the Griman Creek Beds are therefore probably to be correlated with somewhere within the Allaru Mudstone. It is not impossible that younger microfloras may be recovered from the Surat Basin area in the future, although there are indications suggesting that the horizons drilled in Surat Nos 3 and 4 constitute the youngest Cretaceous rocks preserved in the Surat Basin. Future shallow drilling in the area is expected to provide conclusive evidence on this point.

Dinoflagellate Zones

Dinoflagellates and acritarchs were recovered in small to reasonable amounts from the Mitchell and Roma bores (Table 2) and only in minor quantities from Surat Nos 2 and 3 (Table 3). Proportions of marine micro-organisms in the assemblages are averaged and represented in the microfossil distribution chart of Figure 2 as a time/abundance graph.

In spite of the fragmentary picture that emerged from the investigation, the Dingodinium cerviculum Zone and the Muderongia tetracantha/Odontochitina operculata Zone, established by Evans (1966-a,d) were identified. Time relationship with the Cretaceous spore units, briefly mentioned in Burger (1968-b) are reviewed here on the basis of the youngest information.

Dingodinium cerviculum Zone

Evans characterized the Zone by the occurrence of D. cerviculum in the interval succeeding that of Scriniodinium attadalense. The Zone has been identified in association with K 1b-c microfloras from basal marine Cretaceous strata throughout the Eromanga Basin, attributed to the Doncaster and Jones Valley Members of the Wallumbilla Formation. D. cerviculum was also encountered in the interval of the succeeding M. tetracantha/O. operculata Zone (Richmond area); subsequently in the same Zone of Roma No.9 (MFP 4616). Therefore Evans' concept of the D. cerviculum Zone is revised so as to regard the Zone to comprise that part of the range of D. cerviculum that lies above the range of S. attadalense, prior to the first appearance of O. operculata.

Although the Zone was not recognized in the Mitchell and Roma bores by the absence of the index type, it was previously identified in samples from the Doncaster Member of U.K.A. Cabawin No.1 (Burger 1968-a) and of shallow bores drilled in the nearby Augathella area (Burger in Galloway & Ingram 1967). Indications that the top of the Zone is restricted to the Doncaster Member were found in Roma No.9, from which bore the basal Coreena Member produced a rich microplankton assemblage, containing O. operculata and M. tetracantha (MFP 4616).

Muderongia tetracantha/Odontochitina operculata Zone

Evans characterized the Zone by the co-occurrence of M. tetracantha and O. operculata and reported its presence on various occasions from pre-Toolebuc formations in the Eromanga Basin, associated with K 1d microfloras. In agreement with this

Burger identified the Zone within the K 1d interval of the Ranmoor Member in the Richmond area.

In the Surat Basin the two index fossils appeared together in the Coreena/K 1d interval of U.K.A. Cabawin No.1. The present investigation shows that both types occur together not only in the Coreena Member of Roma No.9 (MFP 4616 and 4615, Table 2) within the interval of spore unit K 1d, but also in the overlying strata of Coomrith No.1,MFP 4633 and 4632 (**page** 9) as well as in Surat No.3 (MFP 4612, Table 3), associated with top K 2a/basal K 2b spores.

This means that the overlap in the vertical ranges of both species reaches from the base of unit K 1d up to the base of unit K 2b, at any rate in the Surat Basin. From higher levels no microplankton was recovered, so that the full upward extension of the Zone was not established. Correlation of the upper part of the Zone with unit K 2a in the Eromanga Basin area must also be considered probable, as (distorted) specimens of (?) M. tetracantha were encountered in a K 2a microflora from Longreach No.5 bore (Burger 1968-b). This observation was discarded, however, as no previous records existed of M. tetracantha occurring in post-K 1d levels.

Overlap of the ranges of O. operculata and D. cerviculum, already noticed in the section of Cabawin No.1, and in the northern Eromanga Basin, Richmond and Julia Creek areas, was again established in the K 1d interval of Roma No.9. Remains of possibly D. cerviculum in the section of Surat No.3 (Table 3) indicate that this overlap may not be restricted to the K 1d interval, as the author assumed.

Other types of microplankton occurring in various microfloras are Diconodinium multispinum, Goniaulax edwardsii, various types of Hystrichosphaeridea; while Muderongia mcwhaei appears to be a very rare form, in the Surat Basin as well as in the Eromanga Basin.

Distribution of microfossils

The succession of microfloral assemblages in the Lower Cretaceous of the Mitchell-Roma-Surat area, illustrated in the vertical distribution diagram of Figure 2, appears to resemble closely the spore history in the Eromanga Basin and adjacent areas, treated by Evans (1966-a,c,d) and Burger (1968-b). Index microfossils, discussed in the preceding pages, mark an identical sequence of spore units and Dinoflagellate Zones, by which it is possible to correlate the sediments in the Surat Basin with Cretaceous formations elsewhere. Additional points of similarity were noticed with the spore sequence of the Richmond, Longreach and Tambo areas that had not come out in detail formerly, but may prove important for future palynology.

(1) The first appearance, together with Crybelosporites striatus, of Pilosisporites parvispinosus at the base of unit K 1d in the Richmond area as well as the Roma area.

(2) Overlap of the vertical range of Dingodinium cerviculum and Odontochitina operculata, in association with lower K 1d microfloras. The maximum extent of the overlap is not yet determined but may also include post-K 1d levels.

(3) Introduction of identical tricolpate pollen grains in the spore interval succeeding unit K 2a in the Longreach and Surat areas.

The differences that were noticed in the vertical distribution of some microfossils may partly be attributed to extremely scarce occurrence, partly to more adequate sampling of certain lithologic intervals. These factors may to some degree be reflected in the following points:

(1) The occurrence of Cyclosporites hughesi throughout unit K 2a up to the level at which the first ornamented tricolpate pollen grains appear.

(2) Earlier appearance of Ephedripites sp. in the interval of K 2.

(3) Absence of Plicatella spp. in the K 2 sections of Surat Nos 3 and 4. This spore type has in many places been recovered from post-Toolebuc strata in the Eromanga Basin, and also from areas further north and northwest, in association with K 2b+ spores.

(4) First appearance, prior to the K 2 interval, of Laevigatosporites ovatus, Trilobosporites trioreticulosus, Contignisporites glebulentus, Kraeuselisporites majus, Rouseisporites radiatus. Apparently also Microfoveolatosporis canaliculatus occurs slightly below the level at which Coptospora paradoxa appears (Table 2).

(5) Occurrence of Muderongia tetracantha in combination with Coptospora paradoxa as high as the base of unit K 2b, which means that the M. tetr./O. operc. Zone is to be correlated with the interval of units K 1d and K 2a, contrary to previous belief that unit K 2a was to be correlated with the overlying O. operculata Zone.

(6) Presence of the following types not encountered in the Aptian-Albian of the eastern and northern Eromanga Basin: Foveotriletes parviretis, Densoisporites velatus, Dictyotosporites filosus, Dictyophyllidites pectinataeformis, Foveosporites canalis, Aequitriradites tilchaensis, Trilobosporites purverulentus, Cicatricosisporites pseudotripartitus, Arcellites reticulatus, Balmeisporites cf. tridictyus. Except for F. parviretis and C. pseudotripartitus, each species was represented by a few specimens only in the assemblages. As most of these spores are more or less common in Paradoxa/ K 2 microfloras from more southern and southwestern parts of Australia (Dettmann 1963), approximately northern limits of occurrence of the parent vegetation could be considered.

From a number of points, these six are selected for future reference as they are regarded of particular interest for continued investigation. Thereby special emphasis will be placed on the aspect of geographical spore and pollen distribution, from which data concerning sources of vegetation and directions of spore supply could be derived. From the information discussed in point (6) it appears so far that, at least in lowermost K 2 times, certain dispersed

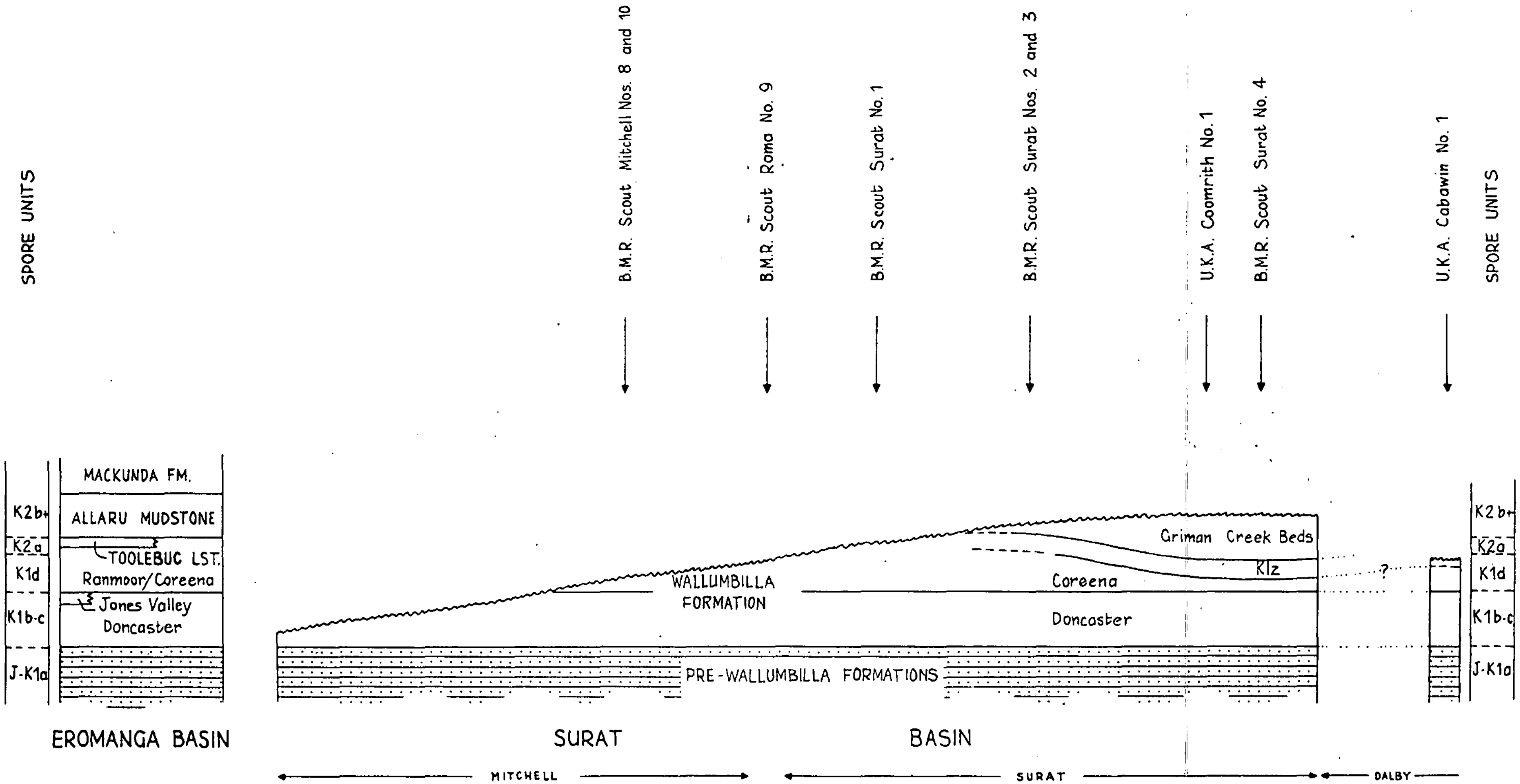

FIGURE 3 : PALYNOLOGICAL CORRELATION OF CRETACEOUS FORMATIONS IN QUEENSLAND

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To accompany Record 1968/125

spores encountered in the Surat Basin area might have been supplied solely from vegetation sources located in approximately southern directions. Palaeogeographical evidence points to southern limits of marine sedimentation and even indicates close nearness of land in K 2b times (see p. 24).

The absence of Plicatella spp. in the K 2b assemblages of the Surat bores and some deep wells further south, in contrast to its wide geographical distribution in more northern areas mentioned in point (3), deserves closer investigation on limits of occurrence. If, as this point might indicate, approximately southwestern limits of occurrence are established, then the existence of vegetation sources in approximately northern to western directions is suggested, from which dispersed spore assemblages were shed into the Basin that appear to be largely similar to those in areas further southeast.

Future stratigraphic drilling in the Cretaceous of the Carpentaria Basin and present stratigraphic drilling by the Geological Survey of Queensland will supply much needed lateral control on the higher Cretaceous spore zonation and add considerably to the picture of the paleogeography in Aptian, Albian and possibly lowermost Upper Cretaceous (Cenomanian) times.

PALYNOLOGICAL CORRELATION OF FORMATIONS

From relationship between spore units and lithological units in the western and central Surat Basin, palynological correlation with the equivalent interval of the northern and eastern Eromanga Basin can be attempted. The palynological age of the formations in the Eromanga Basin, represented in the correlafion chart of Figure 3, is extracted from Evans (1966-a) and Burger 1968-b).

Close relationship of the Doncaster Member with spore unit K 1b-c has now been established from the Richmond area, via the Mitchell area, further eastward as far as the Dalby area, Surat Basin. Burger (in Galloway & Ingram 1967) noticed slight discrepancy in the earliest occurrence of K 1b microfloras in the Tambo-Augathella area (basal Doncaster Member) and in the Roma-Mitchell area (upper Blythesdale Formation). This is a problem connected with facies changes across the Nebine Ridge, but it lies outside the scope of the present investigation.

As discussed at page 10, data available strongly suggest close proximity of the contact between units K 1c and K 1d to the base of the Ranmoor/Coreena Members in the Eromanga and Surat Basins. Wherever studied, unit K 1d appeared to be associated with Coreena/Ranmoor strata. An exception to this rule was found in the central part of the Surat Basin, where the sections of Surat No.3 and Coomrith No.1 show, still in K 1d times, interrupted deposition of the Coreena and replacement by mudstone Klz. Further westwards however, the section of Surat No.1, in which Klz was not identified, shows continuous deposition of Coreena throughout K 1d and K 2a times. The earliest horizons of the overlying Griman Creek Beds appear to be of late K 1d age in the central zone of the Mimosa Syncline (Coomrith No.1, MFP 4631); in Surat Nos 2 and 3 they appear to be of much younger age and do not replace Klz before late K 2a and K 2b times.

The relationship of lithology to spore zonation that emerges from these data is illustrated in Figure 3. The base of Klz and the base of the Griman Creek Beds appear both as time-transgressive horizons in the lithological sequence. Overlapping sedimentation of both formations occurred to the northwest across the Coreena, from the central zone of the Mimosa Syncline onto the Southern Roma Shelf, during the same period in which the Coreena and overlying Toolebuc in the Eromanga Basin were formed.

Unfortunately, geological events affecting the Surat Basin area in younger K 2b+ times remain obscure, as an extended period of erosion removed any evidence of eventually continued deposition. Occurrence of unit Klz and the Griman Creek Beds at the eastern flank of the Mimosa Syncline is being investigated by field work and shallow drilling, but is very probably restricted to the most western part of the Dalby Sheet area, regarding subsurface information that is available. The present investigation shows that strata of presumably the youngest Griman Creek Beds in the central part of the Syncline, that are drilled by Surat No.4, are the palynological equivalent of the Allaru Mudstone in the Longreach area.

Comparison of depositional environments in the Lower Cretaceous of the Surat and Eromanga Basins, based on palynological and macrofossil correlation of formations (Figure 3), reveals that during K 1b-c time (i.e. the time of deposition of the Doncaster Member), dated as Aptian (Vine & Day 1965; Day 1967; Vine et al. 1967), marine conditions prevailed throughout the two areas, coupled with deposition of fine-grained material and the occurrence of sessile and brackish macrofossils, together with appreciable amounts of marine microplankton. Regressive environments occurred in K 1d time (i.e. in the basal Coreena deposition) of Lower Albian age (Vine & Day 1965; Day 1967; Vine et al. 1967), with the supply, in the Surat Basin, of coarser clastics, the occurrence of reworked fossils in intraformational conglomerates and coquinites and a significant reduction of marine microplankton in the microfloras.

Restricted terrestrial environments in the Tambo and Augathella Sheet areas during K 1d-K 2a time (i.e. upper Coreena deposition), dated as (Middle) Albian, were accompanied by the occurrence of intraformational conglomerates and wood fragments, coupled with an absence of marine fossils. Therefore, during K 1d times, marine conditions must have gradually withdrawn from the Surat Basin and part of the eastern Eromanga Basin.

Sediments formed in the Surat Basin area during basal K 2/Albian times, i.e. the upper Coreena, mudstone Klz and the Griman Creek Beds do not reflect the recurrence of marine influence under which, further northwest, the Toolebuc Limestone and Allaru Mudstone were deposited (Exon et al. 1966-a; Vine 1966; Vine et al. 1967; Burger 1968-b). Instead, gradually decreasing brackish-marine conditions culminated in the disappearance of marine microplankton from the microfloras and the appearance of freshwater fossils in the higher Griman Creek Beds. Marine/paralic environments prevailed in the central and northern Eromanga Basin area throughout deposition of the Allaru and (part of) the Mackunda, which is probably Upper Albian in age (Vine *et* Day 1965). From this can be concluded that terrestrial environments must have set in at an earlier stage in the Surat Basin and for a short period also in the Tambo-Augathella area (units K 2a, basal K 2b; Albian), than in the central and northern Eromanga Basin (Winton Formation, units K-u; ?Upper Cretaceous, Cenomanian). Contact with the open ocean must apparently have existed in northern to western directions; this is also suggested by the limits of deposition of the Toolebuc Limestone, mapped in the eastern Eromanga Basin (Exon et al. 1966-a).

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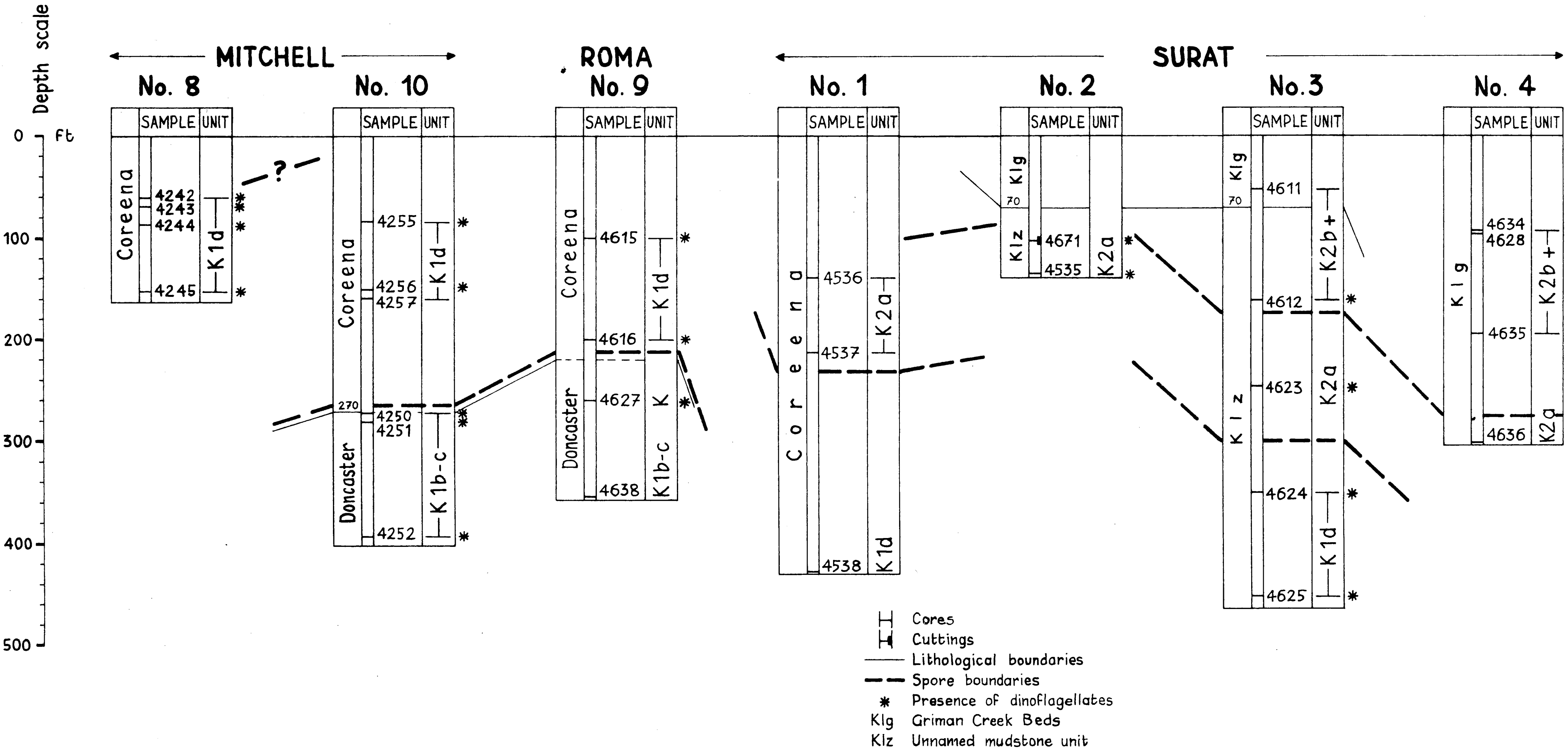

FIGURE 4 - CORRELATION OF SHALLOW HOLES IN THE SURAT BASIN

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To accompany Record 1968/125

TABLE 2: MICROFOSSIL DISTRIBUTION CHART
WESTERN SURAT BASIN AREA

B.M.R. SCOUT HOLE	Mitchell No. 8			
FORMATION / Member	Coreena			
CORE DEPTH	152'	86'10"	68'4"	60'
CORE NUMBER	4	3	2	1
BMR SAMPLE NO. (MFP)	4245	4244	4243	4242
SPORE UNIT	K 1d			
DINOFLAGELLATE ZONE	(Mud. tetr./Od. op.)			
Angiospermous pollen grains		?		?
BALMEISPORITES HOLODICTYUS	?		?	
Cicatricosisporites australiensis	?	x	x	x
hughesi				
ludbrooki			x	
Classopollis spp.	x	x	?	x
Contignisporites cooksonii	x			x
multimuratus				
Coronatispora perforata		x		
Crybelosporites striatus	x		x	x
punctatus				
Cyclosporites hughesi	x			
Densoisporites velatus	?			
Dictyophyllidites crenatus	?			
pectinataeformis				
Dictyotosporites speciosus	?	x	?	
Foraminisporis asymmetricus		x		x
dailyi				
wonthaggiensis				
Foveotriletes parviretis				
Kraeuselisporites majus				
Laevigatosporites ovatus				x
Leptolepidites major				
Lycopodiumsporites circolumenus				x
eminulus		x		x
nodosus			x	?
rosewoodensis			x	x
Matonisporites cooksonii				
Microfoveolatosporis canaliculatus			x	
Osmundacidites cf. mollis				
Pilosisporites notensis		x		
parvispinosus				
Rouseisporites reticulatus				
simplex				
Trilites cf. tuberculiformis				
Diconodinium multispinum	x	x		
Dingodinium cerviculum				
Goniaulax edwardsii		x		
Hystrichsphaerids		x	?	x
Muderongia mcwhaei				
tetracantha				
Odontochitina operculata				
Leiosphaerids				
Indetermin.			x	x
PERCENTAGE OF MICROPLANKTON	2	7	0.5	0.5

B.M.R. SCOUT HOLE	Mitchell No. 10					
FORMATION / Member	Doncaster			Coreena		
CORE DEPTH	393'	281'	272'	159'	150'	83'6"
CORE NUMBER	7	6	6	5	5	4
BMR SAMPLE NO. (MFP)	4252	4251	4250	4257	4256	4255
SPORE UNIT	K 1b-c			K 1d		
DINOFLAGELLATE ZONE	Dingodinium cerviculum +					
Angiospermous pollen grains	x					
BALMEISPORITES HOLODICTYUS						
Cicatricosisporites australiensis	x	x	x	x	x	x
hughesi			?			
ludbrooki	?	?	x			?
Classopollis spp.	x	x	x		x	x
Contignisporites cooksonii			x			
multimuratus		x	x		x	
Coronatispora perforata						
Crybelosporites striatus				x		x
punctatus					?	?
Cyclosporites hughesi	x	x	?			
Densoisporites velatus						
Dictyophyllidites crenatus	x	x	x			x
pectinataeformis						
Dictyotosporites speciosus	x		?		x	
Foraminisporis asymmetricus					x	x
dailyi						
wonthaggiensis						
Foveotriletes parviretis						x
Kraeuselisporites majus					x	
Laevigatosporites ovatus						
Leptolepidites major						
Lycopodiumsporites circolumenus	?		x		x	
eminulus	x	x	x			x
nodosus	x				?	
rosewoodensis	x					?
Matonisporites cooksonii						
Microfoveolatosporis canaliculatus						
Osmundacidites cf. mollis						
Pilosisporites notensis						
parvispinosus						
Rouseisporites reticulatus						
simplex						
Trilites cf. tuberculiformis	x				x	
Diconodinium multispinum	x	x	x		x	
Dingodinium cerviculum						
Goniaulax edwardsii	x		x			x
Hystrichsphaerids		?	x			
Muderongia mcwhaei		?				
tetracantha	x	x				
Odontochitina operculata						
Leiosphaerids						
Indetermin.						
PERCENTAGE OF MICROPLANKTON	10	10	15		0.5	0.5

B.M.R. SCOUT HOLE	Roma No. 9			
FORMATION / Member	Doncaster		Coreena	
CORE DEPTH	354'8"	260'	200'1"	100'2"
CORE NUMBER	4	3	2	1
BMR SAMPLE NO. (MFP)	4638	4629	4616	4615
SPORE UNIT	K 1 b-c		K 1d	
DINOFLAGELLATE ZONE	Ding. cervic.		M. tetr/O. op.	
Angiospermous pollen grains				
BALMEISPORITES HOLODICTYUS				
Cicatricosisporites australiensis	x	x	x	x
hughesi	x			
ludbrooki	?			
Classopollis spp.	x		x	
Contignisporites cooksonii				
multimuratus				
Coronatispora perforata				
Crybelosporites striatus			x	x
punctatus	x		x	
Cyclosporites hughesi				x
Densoisporites velatus				
Dictyophyllidites crenatus				?
pectinataeformis			x	
Dictyotosporites speciosus	x			
Foraminisporis asymmetricus	x	?	x	
dailyi	x		x	
wonthaggiensis	x			
Foveotriletes parviretis				?
Kraeuselisporites majus				
Laevigatosporites ovatus				x
Leptolepidites major			?	
Lycopodiumsporites circolumenus				
eminulus	x			
nodosus	x		x	?
rosewoodensis			x	
Matonisporites cooksonii	x			
Microfoveolatosporis canaliculatus				
Osmundacidites cf. mollis	?		x	x
Pilosisporites notensis	x			
parvispinosus			x	
Rouseisporites reticulatus	?			
simplex				x
Trilites cf. tuberculiformis				?
Diconodinium multispinum			x	
Dingodinium cerviculum			x	
Goniaulax edwardsii			x	
Hystrichsphaerids			x	
Muderongia mcwhaei			?	x
tetracantha			x	x
Odontochitina operculata			x	x
Leiosphaerids	x	x	x	x
Indetermin.				
PERCENTAGE OF MICROPLANKTON	0	?	55	15

To accompany Record 1968/125

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TABLE 3: MICROFOSSIL DISTRIBUTION CHART
CENTRAL SURAT BASIN AREA

B.M.R. SCOUT HOLE	Surat No. 1			Surat No. 2		Surat No. 3					Surat No. 4		
FORMATION / Member	Coreena			Klz		K l z				Klg	Griman Creek Beds		
CORE DEPTH	428'1"	213'1"	139'1"	135'5"	100-110'	452'4"	350'	246'5"	161'3"	52'3"	302'11"	196'	93-94'
CORE NUMBER	5	4	3	1	cutt	5	4	3	2	1	3	2	1
BMR SAMPLE NO. (MFP)	4538	4537	4536	4535	4671	4625	4624	4623	4612	4611	4636	4635	4628/34
SPORE UNIT	K 1d	K 2a		K 2a		K 1d		K 2a	K 2b+		K 2a	K 2b+	
DINOFLAGELLATE ZONE	Mud. tetr./O. operc?			M.t./O.o?		Mud. tetr./O. operc.							
Aequitriradites spinulosus	x	?			x	?	x	x	x	x			
verrucosus	x	?			x		?	x	x	x			
tilchaensis												x	
Angiospermous pollen grains		?	x		x			?	x	x		x	x
ARCELLITES RETICULATUS									x	x	x		
BALMEISPORITES HOLODICTYUS		x				?			x	x	x	x	x
TRIDICTYUS												?	
Cicatricosisporites australiensis	x	x	x	x	x	x	x	x	x	x	x	x	x
hughesi		x		x	x		x		x	x		x	x
ludbrooki	?	x		?			x			?			
pseudotripartitus		?		x	x		?	?	x		?		
n. sp.	?	x					?	x	x				
Classopollis spp.		x	x	x	x			x	x	x	x	x	
Contignisporites fornicatus				x	x				x		x	x	x
glebulentus	x	?		x									
multimuratus		x		x									
Coptospora paradoxa		x	x	x				x	x	x	x		x
Crybelosporites punctatus		x	?				?		x	x	x	x	x
striatus	x	x	x	x	x	x	x	x	x	x	x	x	x
Cyclosporites hughesi			x		x		x	x	x		x		
Densoisporites velatus		x											
Dictyophyllidites crenatus		x	x		x				x	x	x	?	x
pectinataeformis			x									x	
Dictyotosporites filosus				x									
speciosus				x	x	x			x	?	x		
Ephedripites sp.				x					x	x			
Foraminisporis asymmetricus	x	x		x	x	x	x	x	x	x		x	x
dailyi		x			?	x	x		x	x		x	x
wonthaggiensis	x	x	x	x	x		x	?	x	x			x
Foveosporites canalis					?								
Foveotriletes parviretis		x	x	x	?				x	x			?
Kraeuselisporites majus											x		
Laevigatosporites ovatus					x				x	x	x	x	x
Leptolepidites major	x				x					x	x		
Lycopodiacidites ambifoveolatus										x			
Lycopodiumsporites circolumenus				x	x				x	x			
eminulus		x		x	x	x	x	?	x	x	x		x
nodosus	x	x	x	?	x	x	?	x	x	x	x	x	x
rosewoodensis	x	x											x
Matonisporites cooksonii		?			x	?				x			x
Microfoveolatosporis canaliculatus										x		x	x
Osmundacidites cf. mollis		?					x	?	x				
Peromonolites peroreticulatus									?	?			
Pilosisporites grandis												x	
notensis		x		x	x		x		x	x		x	
parvispinosus	x	x		x	x		x	?	x	x			x
Rouseisporites radiatus	x	x			?		x	x	x			x	
reticulatus							x		x	x		?	
simplex		x		x	x		?	?	x	x	x	x	
Trilites cf. tuberculiformis		x	x	x	x		?		x	x			x
Trilobosporites purverulentus	x	x										?	
trioreticulosus		x		x	x	x	x		x	x	x	x	x
Diconodinium multispinum						?							
Dimgodinium cerviculum							?		?				
Goniaulax edwardsii					x	x			?				
Hystrichosphaeridea				x	x								
Muderongia mcwhaei							x						
tetracantha						?	x	x	x				
Odontochitina operculata		?		?			?	?	x				
Leiosphaerids								x	x	x			
Botryococcus										x			x
PERCENTAGE OF MICROPLANKTON				0.0	0.0	1	0.5	0.5	0.0				

To accompany Record 1968/125

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