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PALYNOLOGICAL COMPARISON OF THE COOPER AND GALILEE BASINS

by

P.R. Evans

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ABSTRACT

Investigation of the spores and pollen grains in samples from the Alliance Chandos No. 1 Well, central Queensland, which produced some oil from the Triassic, provided a means of comparing the palyno-stratigraphic sequences in the Cooper and Galilee Basins. The data from Chandos No. 1 and available evidence from the southern Cooper Basin suggests that deposition in both basins was completed in four major phases, a basal "fluvioglacial" stage of (?) Upper Carboniferous - Lower Permian age (units Cl-Plb), a Lower Permian coal measure period (units Plc-P2), a (?) Lower - Upper Permian (unit P3b-4) period of further coal deposition, and a Lower Triassic period of an as yet little understood facies. Pauses in sedimentation seem to have occurred between each phase. There is no evidence of acritarch bearing horizons in the Cooper Basin, although they have been observed in the Galilee Basin. Jurassic - basal Cretaceous sediments overlying the northern end of the Cooper Basin may be correlated with formations mapped in the northern parts of the Eromanga Basin.

INTRODUCTION

Alliance Oil Development Australia N.L. drilled Alliance Chandos No. 1 in Authority to Prospect 98P, central Queensland, between 27th February and 24th August 1966. The well encountered hydrocarbons within the Triassic, and palynological studies on core samples were undertaken during drilling to ascertain the age of strata being penetrated. The rock and spore sequences showed similarities with those in the Galilee Basin to the north east. However, as Chandos No. 1 appeared from geophysical evidence to be located towards the northern end of the Cooper's Creek Basin* (Kapel, 1966) it was better to compare the well section with those drilled by Delhi Australian Petroleum Ltd in the southern part of the Basin. As records of palynological studies from the latter area are scattered and meagre a review of the available evidence was undertaken and slides, prepared by Mr Harris from Gidgealpa No. 1 and kindly loaned by the South Australian Mines Department, were examined.

This work resulted in a subdivision of the Permian and Triassic strata of Chandos No. 1 and a broad correlation scheme between the Cooper and Galilee Basins in terms of the palynological units previously derived for the Galilee Basin (Evans, 1964, 1966a), which show that the depositional history of the basins in Upper Carboniferous, Permian and Triassic times are similar in several respects.

The Mesozoic section of Chandos No. 1 was sampled by few cores and little information of general value has been obtained from it. However, certain log similarities and the few palynological data available show how the pre-marine Cretaceous Mesozoic sections compare with wells drilled to the north, such as Newlands No. 1, from which better data are available (Evans, 1966b). Palynological comparisons with the Mesozoic of wells to the south of Chandos cannot be adequately made yet until additional evidence becomes available. Such evidence was not sought for the purposes of this study.

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* In order not to confuse it with a hydrological division, the basin's name is shortened to Cooper Basin (Casey & Konecki, in prep.).

The following notes therefore outline the evidence for dating the section penetrated by Chandos No. 1 and explain how it assists correlation between the Cooper and Galilee Basins.*

OBSERVATIONS

The approximate locations of wells discussed and some of their neighbours are plotted in the insert diagram to Plate 1; their coordinates are listed in Table 1 below.

WELL	LATITUDE	LONGITUDE	GL	KB	TD
Chandos No. 1	25°50'28"S	143°19'20"E	725'	738'	9775'
Dullingari No. 1	28 07 55	140 52 30	304	320	11175
Galway No. 1	25 04 27	142 33 19	188	203	8867
Gidgealpa No. 1	27 58 46	140 04 56	165	181	13114
Gidgealpa No. 3	27 58 27	140 03 05	160	176	10934
Maranda No. 1	23 12 14	145 26 38	850	862	6491
Merrimelia No. 1	27 47 05	140 06 55	164	180	10332
Merrimelia No. 2	27 41 60	140 14 04	192	208	13011
Mt Howitt No. 1	26 37 27	142 28 17	461	477	7719
Newlands No. 1	23 52 30	142 57 45	705	719	5872
Orientos No. 1	28 03 20	141 25 38	459	474	11527
Yongala No. 1	25 13 19	143 55 48	668	683	10187

TABLE 1: WELL CO-ORDINATES

Alliance Chandos No. 1

Spores and pollen grains detected in the Permian and Triassic sections of Chandos No. 1 are listed in Table 2; those from the basal Cretaceous in Table 3. A complete list of samples examined, including barren ones, are marked on Plate 1.

In a clay float derived from the coarse sandstone of core 6, 6869 feet, a well preserved assemblage was found consisting of:

Cyathidites cf. minor (sp. 313)
Baculatisporites comaumensis (sp. 315)
Ischyosporites marburgensis (sp. 323)

* Kapel (1966) considered that the Cooper Basin was a sedimentary basin from Lower Palaeozoic to at least basal Cretaceous time. This is an inappropriate place in which to discuss the implications of this concept, but for the present purposes the term Cooper Basin is restricted to the area containing ?Upper Carboniferous, Permian, and Triassic sediments; thereby it becomes similar in scope to that of the Galilee Basin (Vine et al., 1965).

SPECIES	NO.	TRIASSIC			PERMIAN		
	UNIT	Tr2a	Tr1b		P3b-4	P1c	P1b
	DEPTH	7525'	7690'	7774'	7812'	7948'	7976'
	CORE	c. 8	c. 9	c.10	cutt.	c.12	c.14
	MFP	4036	4044	4066	4086	4067	4069
Retusotriletes diversiformis	6		?		+		
Cyathidites sp.	218	?	+				
Todisporites sp.	219	+	+				
Discisporites sp.	241	+					
Densoisporites playfordi	243	+	+				
Cingutriletes sp.	245	?	+	+			
Cingulati sp.	247	+					
Polypodiites ipsvichiensis	255	+					
Striatiti sp.	262	+					
Taeniaesporites sp.	263	+					
Striatiti sp.	368	?					
Concavisporites sp.	222		+				
"Distalanulisporites" sp.	242		+				
Kraeuselisporites sp.	246		+	+			
Punctatosporites sp.	253		+				
Polypodiidites sp.	256		+				
Monosaccites sp.	258		+	+			
Striatiti sp.	260		+	+			
Striatiti sp.	261		+	+			
Alisporites australis	277		+	+			
Platysaccus queenslandi	278		?	+			
Densoisporites brevicula	353		+	+			
Cingulati sp.	354		?				
Apiculati sp.	355		+	+			
Apiculati sp.	369		+				
Kraeuselisporites sp.	623		+				
Quadrisporites horridus	211			+			+
Disaccites sp.	279			+			
Rugulatisporites sp.	371			+			
Anapiculatisporites ericianus	115				+		
Disaccites sp.	137				+		
Striatopodocarpidites cancellatus	143				+		
Protohaploxypinus amplus	147				+		
Leiotriletes directus	207				+	+	
aff. Gnetaceaepollenites sp.	208				+		
Megaspore sp.	685					+	
Vesicaspora ovata	138					+	
Protohaploxypinus sp.	144					?	
Apiculatisporis cornutus						?	
Cingulati spp.						+	
Disaccites spp.						+	
Monosaccites sp.	44						+
Parasaccites sp.	50						+
Protohaploxypinus sp.	80						+
Disaccites sp.	82						+
Monocolpates sp.	164						+
Lophotriletes sp.	183						+
Monocolpates sp.	186						+
aff. Protohaploxypinus gaoraiensis	187						+
Parasaccites sp.	190						+

TABLE 2 : MICROFLORAL DISTRIBUTION CHART - CHANDOS NO.1 (PERMIAN & TRIASSIC)

SPECIES			
	AGE	L. CRET.	
	UNIT	Kla	
	DEPTH	4682½'	4685'
	CORE	c. 1	c. 1
	MFP NO.	4147	4148
Cyathidites cf. minor	313	+	+
Applanopsis dampieri	335	+	+
Cyathidites australis	374	+	+
Ceratosporites aequalis	376	+	
Stereisporites antiquasporites	378	+	
Foraminisporis wontaggiensis	381	+	+
Foraminisporis assymetricus	386	+	
Apiculati sp.	392	+	
Cicatricosisporites ludbrooki	394	+	+
Contignisporites cooksonii	396	+	+
Podocarpidites cf. P. multesinus	400	+	+
Cycadopites nitidus	402	+	+
Cicatricosisporites australiensis	403	+	+
Microcachryidites antarcticus	404	+	+
Neoraistrickia truncata	413	+	
Leptolepidites verrucatus	414	+	
Foraminisporis dailyi	415	+	+
Lycopodiumsporites circolumenus	418	+	
Dictyotosporites speciosus	424	+	+
Schizosporis reticulatus	428	+	+
Osmundacidites wellmanii	438	+	
Apiculati sp.	449	?	
Sculptatomonoleti sp.	477	+	
Cyclosporites hughesi	489	+	+
Perinate sp.	492	+	
Rouseisporites reticulatus	644	+	
Dulhuntyispora parvithola	123		+
Alisporites grandis	330		+
aff. Laricoidites sp.	331		+
Laevigati sp.	375		+
Lycopodiumsporites cf. L. facetus	398		+
"Gen. et sp. indet. Form A" Eis. & Cooks.	405		+
Klukisporites scaberis	417		+
Ischyosporites punctatus	420		+
Januasporites spinulosus	649		+
Crybelosporites stylosus	714		+

TABLE 3 : MICROFLORAL DISTRIBUTION CHART - CHANDOS NO.1 (CRETACEOUS)

Concentrisporities hallei (sp. 329)
Alisporites grandis (sp. 330) (common)
aff. Laricoidites sp. 331
"Inaperturuopollenites" turbatus
Tsugaepollenites segmentatus
Classopollis cf. C. classoides (sp. 336) (fairly common)
Podocarpidites cf. P. ellipticus (sp. 343) (common)
Araucariacites australis (sp. 345)
Perinate sp. 672
Conidiophore indet.
Parasaccites spp.
?Geminospora lemurata
Laevigatosporites ovatus
Angiospermous pollen grains

The sum of this assemblage is typical of the interval of Jurassic units J2-3. It was a little surprising to discover the spores in view of the sample's lithology, and the assemblage's autochthonous character might be questioned, the presence of the microfossils being attributed to mud impregnation of the porous sandstone. The one specimen of L. ovatus and the rare angiospermous pollen grains could have entered the sample from the mud, being derived respectively from the Cretaceous and perhaps the drilling mud water supply. The remainder of the assemblage is most likely to represent the sampled horizon because it is consistent with known J.2 assemblages and because the individual grains are uncompressed, a character typical of microfloras preserved in sandstones. The rare specimens of Parasaccites spp. are recycled from the early Permian and the ?Geminospora lemurata from the Devonian.

Core 5, 6446 feet yielded few determinable specimens, and core 4, 5925 feet yielded relatively abundant, but poorly preserved grains among a large volume of vegetative debris. A full search and count of the assemblage in core 4 has not been undertaken, but it did not appear to contain species characteristic of units J5-6, and it possessed Januasporites sp. 548, which is unknown below J4. Hence a J4 age is assigned to it.

Delhi-Santos Dullingari No. 1

Samples from Dullingari No. 1 were separately examined by Balme and Evans (Appendix 3 in Harrison & Greer, 1963). Samples down to core 25, 9010 feet, were also examined in the B.M.R., although the results obtained were not included in the well completion report. None of the residues from the Permian was well preserved, the spores were carbonized, and, in common with most preparations from the Permian of the southern Cooper's Creek area, they contained a preponderance of woody tissue.

In summary:-

Cuttings 6850 feet
Core 16, 6901 feet
Cuttings 7007 feet
Core 17, 7204 feet

yielded assemblages with Dulhuntyispora parvithola, (sp. 123), "Marsupipollenites" sinuosus (sp. 151), Anapiculatisporites ericianus (sp. 115), A. dentatus, and Microbaculispora villosa, which class these horizons within the late Permian unit P3b-4.

Core 18, 7482 feet, is still of uncertain age, although provisionally it is indicated as (?)P2. Both Evans and Balme (op. cit.) report A. villosa from the core, but re-examination of the B.M.R. preparations has not confirmed this record; the specimens in question should be otherwise named. Full re-examination of the B.M.R. preparation revealed no other fossils which might be regarded as typical of unit P3b-4 and hence it may be thought of as older than previously implied, i.e. within the range P2-P3a. Such a determination would of course fit well the theory discussed on p. 11 that the clearly defined uppermost Permian lithological division in the southern Cooper Basin represents the time interval in which the P3b-4 assemblages were developed. If Dullingari No. 1, core 18, should also be ascribed to unit P3b-4, any hiatus below this lithological division (thought to exist by Greer, 1965, and Kapel, 1966) is of limited magnitude at Dullingari.

Core 22, 8276 feet yielded very few spores, but included a specimen here identified as Verrucosisporites pseudoreticulatus (sp. 68), which ranges through Plc-P2.

Delhi-Santos Gidgealpa No. 1

Seven wells have been drilled on the Gidgealpa structure, but palynological information is only generally available from the first three, which were subsidized by the Commonwealth. Harris (in Harrison & Higginbotham, 1964a) recorded spores in cores and sidewall cores from Gidgealpa No. 1. Slides from Harris' preparations from Permian horizons yielded:

Core 6, 7780 feet:

Leiotriletes directus (sp. 207)
Anapiculatisporites ericianus (sp. 115)
Calamospora diversiformis (sp. 6)
Granulatisporites micronodosus (sp. 110)
Striatiti spp. (common)
?"Marsupipollenites" sinuosus (sp. 151)

which could tentatively be thought of as P3b-4 in age.

Core 7, 8208 feet:

Striatiti spp. (large) (fairly common)
Disaccites spp. (fairly common)
Kraeuselisporites sp. (fairly common)
Leiotriletes directus (sp. 207)
Verrucosisporites pseudoreticulatus (sp. 68)
Polypodiidites cicatricosus (sp. 134)
Parasaccites sp. 52

of about P2 age.

Core 8, 8298 feet:

Striatiti spp. (fairly common)
Monosaccites (Parasaccites spp.) (fairly common)
Marsupipollenites triradiatus (sp. 152)

of Plc or P2 age.

Core 9, 8616 feet:

Monosaccites spp. (fairly common)
Striatiti spp. (fairly common)
Verrucosisporites pseudoreticulatus (sp. 68)
Kraeuselisporites spp. (fairly common)

of Plc age.

Delhi-Santos Gidgealpa No. 3

Samples from three cores of Gidgealpa No. 3 were examined by Harris (in Harrison & Higginbotham, 1964b). They were taken at:

Core 1, 7120 feet
Core 2, 7200 feet
Core 3, 7325 feet.

Harris recorded Dulhuntyispora parvithola in both cores 1 and 3 which should hence be allocated to unit P3b-4.

Oil Development Maranda No. 1

A stratigraphic analysis of Maranda No. 1 on the basis of palynology was first reported by de Jersey *et al.* (1963) and subsequently by Evans (1964, 1966). The latter opinions are accepted without review for this report. A number of wells have now been drilled in the Galilee Basin, but Maranda No. 1 is chosen to represent them as it penetrated the best sampled section.

Delhi-Santos Merrimelia No. 1

Spores were recorded by Harris from only core 11, 9206 feet, in Merrimelia No. 1 (Yonge, 1965). He found an assemblage of, "?Vesicaspora sp., Nuskoisporites sp., and Potonieisporites sp." and compared it with the assemblage in the Lake Phillipson Bore at 2283 feet, which Balme (1957) considered might be as old as the Upper Carboniferous. This is the only sample of the basal conglomeratic sequence which Greer (1965), Canaple & Smith (1965), and Kapel (1966) refer to as the "Permo-Carboniferous". Unfortunately this is meagre evidence on which to base an age determination and the problem will be again considered in a later report dealing with wells in the area noted as the "Pedirka Basin" by Kapel (1966).

Delhi-Santos Merrimelia No. 2

A large number of samples from Merrimelia No. 2 were examined by Rade (in Papalia, 1965). Of his numerous observations two points are relevant to the discussion. At 7065 feet he reported a Jurassic assemblage which contained Applanopsis dampieri (Unit J2 or younger) and at 7147 feet he recognized a Triassic assemblage, thus giving an interval of 82 feet in which the Jurassic/Triassic boundary should be sought. Secondly he reported an assemblage change between 7207 and 7231 feet at which Densoisporites (al. Lundbladispora) playfordi cut out, which could represent the top of unit Tr2.

Amerada Newlands No. 1

Evans (1966c) examined the pre-marine Cretaceous of Newlands No. 1 and confirmed the stratigraphic analysis of the well effected by Amerada Petroleum Corporation of Australia Ltd (1966). It is possible to extend these analyses to cover the Mesozoic to Chandos No. 1.

Delhi-Santos Orientos No. 1

Samples of cores and sidewall cores from Orientos No. 1 were examined by de Jersey and Harris (in Harrison, Greer & Higginbotham, 1963) who, among a number of barren samples, recognized Jurassic, Triassic and Permian horizons. They considered the Permian samples:

Sidewall core 22, 6112 feet
Core 6, 6242-52 feet

to be Upper Permian in age. In terms of the Galilee Basin sequence the lower sample is possibly of P3b-4 age as it contained an abundance of striate pollens grains and specimens of Anapiculatisporites ericianus (sp. 115).

Alliance Yongala No. 1

Core samples from Yongala No. 1 were examined by Evans (in Laing, 1966) and the fossil lists are not repeated here.

DISCUSSION

Pre-Upper Carboniferous

The Upper Carboniferous and basal Permian of the Galilee and Cooper Basins rest unconformably on both intrusive and sedimentary rocks of ages varying from ?Precambrian to Lower Carboniferous. Palynomorphs as old as the Devonian have been obtained from the Adavale and Drummond Basins, which underlie the Galilee Basin (e.g. de Jersey, 1966), but none has been found below the Cooper Basin, although extractions from pre-Permian levels in Innamincka No. 1, Dullingari No. 1 and Chandos No. 1 have been attempted.

Upper Carboniferous - Lower Permian

Units Cl-Plb

Units Cl-Plb form not only a distinctive palynological group, but everywhere they are associated with sediments usually described as of "fluvioglacial" origin.

The older units Cl-2 have not been identified in the Cooper Basin, although they are present in the Galilee Basin to the north east, and at least locally in the "Pedirka Basin", to the west. Failure to identify these units may be largely due to the severe carbonization spores within sediments which could represent them, and on the lack of samples with which to tackle the problem. Units C1-2 might be found in the "Permo-Carboniferous" conglomeratic sequence penetrated by several wells in the Cooper Basin, but the microflora in the only sample from this formation which yielded spores (Merrimelia No. 1), could belong to any horizon within the range Cl-Plb.

Greer (1965), Canaple & Smith (1965) and Kapel (1966) emphasized that structures within the Cooper Basin were actively growing during the Permian and it is possible that beds as old as C1 and C2 might be present on the flanks of such structures, although they remain undrilled.

A very thin veneer of sediments of Plb age was detected in Chandos No. 1, represented by cores 13 and 14 (7966 and 7976 feet), immediately overlying with presumed unconformity sandstones of ?Devonian age and underlying more carbonaceous sediments of Plcage. The spores and pollen grains at 7976 feet were badly corroded by carbonization, but they were abundant and sufficiently distinctive for positive assemblage identification. In contrast, the microfloras at 7966 feet were very sparse and not listed in Table 2, but those fossils present were mainly fragmented, large, monosaccate pollen grains which are so characteristic of Unit Plb.

Lithologies associated with Plb in the Galilee Basin are not usually conglomeratic, but frequently are carbonaceous and show varvoid banding and a substantial content of feldspathic, (?) tuffaceous matter, characteristics also displayed in Chandos No. 1.

Unit Plc-P2

On the present state of knowledge it is difficult to separate units Plc and P2 without the presence of acritarchs on which unit P2 was founded in the Bowen Basin; in the absence of these fossils the spore assemblages in both are fairly similar and more work on separating them is required. In this respect the evidence from Gidgealpa No. 1 is of interest as within the interval which must be marked as Plc-P2, by the presence of Varrucosisporites pseudoreticulatus (sp. 68), there is a marked decrease in the content of monosaccate pollens in higher horizons compared to the lower ones, a change which is directly comparable with the sequence in Arbroath No. 1, where the Reid's Dome Beds, which elsewhere are taken as Plc in age, have yielded useful assemblages. At the higher levels within this range the striate and non-striate disaccate pollen grains are the dominant components of the assemblage and at times, without the supporting evidence from the trilete spores such levels could be confused with the even younger P3b-4 horizons.

The presence of beds relatable to Plc-2 in the Cooper Basin is firmly established in the Gidgealpa No. 1, Dullingari No. 1 and Chandos No. 1 Wells. In Plate 1, their presence in Orientos No. 1 is inferred by lithological correlation. It would appear that a distinctive portion of the Permian sequence in the southern half of the basin belongs to these units, coinciding with the lower two members of the Gidgealpa Formation. At present, however, there is no positive way of separating these two lithological members by palynological means, even though they are apparently separated by disconformity. How much of this lack of achievement is due to the poorly preserved and cursorily examined and recorded assemblages, and how much to the lack of assemblage diversity cannot be judged.

Sediments of Plc-2 age in both the Cooper and Galilee Basins are distinctly carbonaceous, with discreet coal seams, in contrast to the underlying "fluvioglacials", but comparable with the overlying carbonaceous beds of P3b-4 age.

Lower(?) - Upper Permian

Units P3b-4

Unit P3b commences in the Freitag Formation (Power, 1966) below the Ingelara Formation in the Bowen Basin and hence commences at least in the Lower Permian Artinskian Stage, and extends to the top of the Permian. However, without the associate acritarchs of the Bowen Basin (Denison Trough), further division of the interval has not been obtained, and a Lower - Upper Permian age must be assigned to it.

The spores of units P3b-4 include a number of distinctive species. When encountered in the Galilee Basin, the individual assemblages within these units are fairly complete, but those assigned to the units in the Cooper Basin generally contain a very high proportion of saccate pollens and few spores and it is difficult to identify the samples' age with certainty without prolonged searching. The lack of distinctive spores is probably an environmental feature of the basin, but once again the lack of well preserved assemblages precluded firm deductions about the subject.

Whatever assemblage differences may exist within the late Permian P3b-4 horizons of the two basins, the associated rocks are lithologically similar in their development of major coal seams. It is thereby extremely difficult to pick the difference between such beds and the underlying sediments of Plc-2 age. Rock units associated with units P3b-4 and Plc-2 in outcrops in the Galilee Basin are separated by the unconformity between the Colinlea Sandstone and the Reid's Dome Beds. This break is discernable in some wells, such as Maranda No. 1 and Alice River No. 1 (Evans, 1966b), but not in others, such as Marchmont No. 1 and Saltern Creek No. 1, except by palynology (Evans, 1964). The apparent break to units P3b-4 in the Cooper Basin seems to correspond to the disconformity between the middle and upper members of the Gidgealpa Formation. The position of a similar hiatus which most likely exists within the Permian of the Chandos area cannot be positively detected from so thin a section, but for the present its location is chosen at the base of a sandstone at 7896 feet, subject to revision if more evidence becomes available.

Triassic

The presence of Triassic sediments across the Cooper Basin has been recognized since its identification in Dullingari No. 1, but its allocation to divisions of the system other than Lower Triassic has not been attempted, except by Rade, who compared the sequence in Merrimelia No. 2 to the Rewan Formation, Clematis Sandstone and Moolayember Formation of the Bowen Basin (in Papalia, 1965). The ranges of his critical fossils are not born out in typical sections of these formations, but inspection of the range chart from Merrimelia No. 2 suggests that there is a considerable fossil change between 7207 and 7231 feet, the top of the range of Densoisporites (al. Lundbladispora) playfordi, which would correspond approximately to the top of unit Tr2 (Evans, 1966a). This horizon would then correlate with the base or within basal levels of the Clematis Sandstone of the Bowen and Galilee Basins. The overlying Triassic in Merrimelia No. 2 could correlate with all or part of the remainder of the Clematis Sandstone.

Cores from Chandos No. 1 and Dullingari No. 1 show that units Trlb and Tr2a are represented in the Cooper Basin. Core 10, 7774 feet, in Chandos No. 1, from just above the contact with the Permian, yielded a microflora more akin to high levels in unit Trlb and the existence of an hiatus between the Permian and Triassic in the Chandos area is fairly certain. But the age of the youngest Triassic in the basin is not yet adequately determined.

A distinctive feature of the Triassic of the Cooper Basin is its high organic content, compared to its correlates in the Bowen and Sydney Basins where typical red beds are developed. However, as evidenced by several attempts to extract a microflora from Chandos No. 1, core 7, this organic content may consist of winnowed vegetative debris only, with no spores or pollen grains remaining. Undoubtedly these characters are the products of distinctive environments of deposition, and comparisons in the future between bulk assemblages which might further reflect these environments may be fruitful.

Jurassic - Cretaceous

The position of the unconformity separating the Triassic and Jurassic, which is depicted on Plate 1, is chosen from an inspection of described lithologies and gamma ray logs over intervals between horizons dated by spore content. This line differs in the Chandos - Yongala area from Laing's choice (1966) of the base of the Jurassic at the base of "unit L" of the "Yongala Group". Admittedly the present choice remains partly conjectural, but evidence from sections in the Phillips Petroleum wells in the portion of the Eromanga Basin, which overlies the Adavale Basin to the east of Yongala, and from recent drilling in the Cooper Basin to the west of Chandos suggests that sediments as old even as Jurassic unit J1 were deposited in the region, giving a total thickness of sedimentation through J1(?) - J3 time comparable to that marked in Plate 1.

The meagre palynological evidence available from the southern Cooper Basin is sufficient for instance to show the overlapping effect of late Jurassic sediments at Orientos and the incoming further westwards of that well of older Jurassic J2-J4 sediments which largely account for the increase in total thickness of the Jurassic towards Gidgealpa.

Laing subdivided the pre-Cretaceous sequence of Yongala No. 1 into a series of lithological divisions A-L of the "Yongala Group". Comparison of logs shows that among these divisions may be recognized equivalents to named formations in the more northerly parts of the Eromanga Basin. This becomes apparent by following correlations discussed by Vine (1966), Amerada Petroleum Corp. of Australia Ltd (1966) and Evans (1966) from Mayneside No. 1 to Newlands No. 1 and then to Chandos No. 1. The few microfloral data from the Jurassic of Chandos and Yongala, compared with the more detailed evidence from Newlands No. 1 confirm that these correlations are feasible.

Evidence from Newlands No. 1 suggests that the base of palynological unit Kla commences within equivalents of Laing's lithological unit D. Unit Kla then extends upwards apparent to about the top of the Hooray Sandstone equivalent, high up in Laing's unit B. Core samples from unit B were examined from both Yongala No. 1 and Chandos No. 1. Neither core has yielded Murospora florida and might be thought of as younger than Kla. However, both yielded "Gen. et sp. indet. Form A" Eisenack & Cookson 1960 (sp. 405), which seems to be a representative of unit Kla (Evans, 1966c, e).

Whereas the core from unit B at Yongala yielded a few microplankton (dinoflagellates) none was found in samples from Chandos No. 1, a factor which might be of significance to future environmental studies.

CONCLUSIONS

The depositional histories of the Cooper and Galilee Basins were closely comparable.

The ages of the early stages of development of the Cooper Basin are little documented because of the lack of suitable study material, either from a lack of samples or because of the severe carbonization and consequent loss of fossils suffered in critical sections. Lithological comparisons indicate that "fluvioglacial" sediments were dropped in the basin, similar to those filling much of the Galilee Basin. Spores from Chandos No. 1 show that such deposition at least in the northern part of the Cooper Basin commenced in Plb times, after deposition commenced in the Galilee Basin. However, it is possible that older (?) Upper Carboniferous deposits might exist in the undrilled synclinal areas of the basin.

In both basins the "fluvioglacials" were succeeded by coal measures of Lower Permian Plc - P2 times. Divisions of the coal measures on a lithological basis in the Cooper Basin are recognized but palynological evidence is too meagre to confirm them. Carbonization again appears largely responsible for the lack of data.

After a pause in sedimentation, if not erosion, deposition of coal measures recommenced in both basins during Permian P3b-4 times.

Permian deposition was considerably attenuated in the Chandos area, compared with more southerly parts of the Cooper Basin, although representatives of all the phases of deposition listed above are preserved there.

Lower Triassic sedimentation extended across the Cooper Basin, although in different facies to its counterparts in the Galilee Basin. Correlates of the late Triassic Moolayember Formation of the Galilee Basin have not yet been positively determined in the Cooper Basin, but its basal equivalents might be present at Merrimelia.

Lithological and palynological divisions of the Jurassic and basal Cretaceous above the northern part of the Coopers appear conform to divisions recognized in the north eastern Eromanga Basin.

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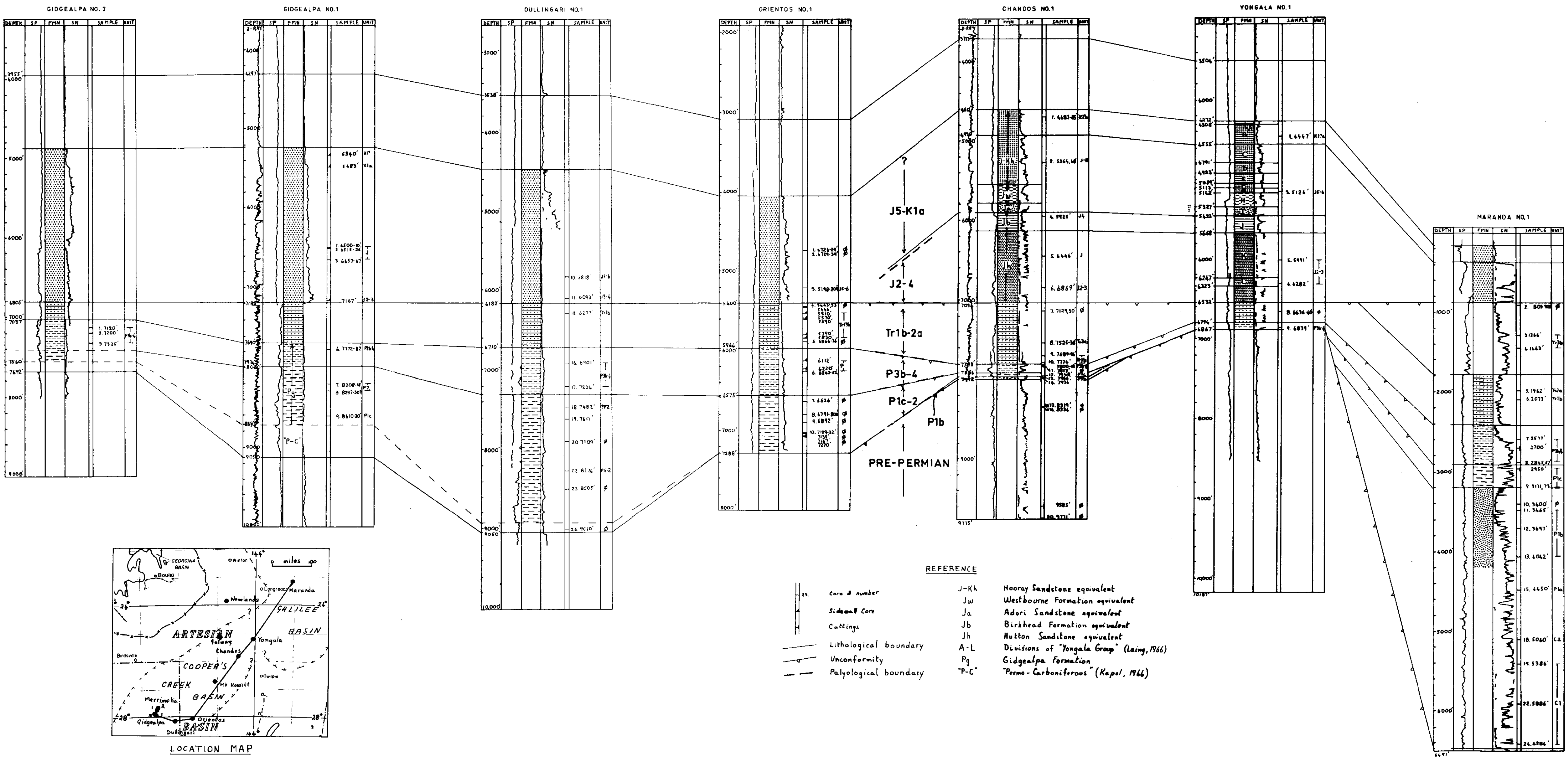
CORRECTIONS TO PLATE 1.

1. Location sketch map for "Cooper's Creek Basin" read "Cooper Basin".

2. Stipple patterns representing rock units in Chandos No.1 and Yongala No.1 imply that equivalents of the Hooray Sandstone commence at the base of the Yongala Group Unit G (5142 feet), whereas, the top of unit G (5113 feet) is a more appropriate choice.


GIDGEALPA NO. 3
GIDGEALPA NO. 1
DULLINGARI NO. 1
ORIENTOS NO. 1
CHANDOS NO. 1
YONGALA NO. 1
MARANDA NO. 1
DEPTH
SP
FMN
SN
SAMPLE
UNIT
J5-K1a
J2-4
Tr1b-2a
P3b-4
P1c-2
P1b
PRE-PERMIAN
REFERENCE
Core & number
Sidewall Core
Cuttings
Lithological boundary
Unconformity
Palyological boundary
J-Kh Hooray Sandstone equivalent
Jw Westbourne Formation equivalent
Ja Adori Sandstone equivalent
Jb Birkhead Formation equivalent
Jh Hutton Sandstone equivalent
A-L Divisions of "Yongala Group" (Laing, 1966)
Pg Gidgealpa Formation
"P-C" "Permo-Carboniferous" (Kapel, 1966)
GEORGINA BASIN
Boulia
Winton
Longreach
Maranda
Newlands
GALILEE
ARTESIAN
BASIN
Galway
Yongala
Chandos
Birdsville
COOPER'S
CREEK
BASIN
Mt Howitt
Quilpie
Merrimelia
Gidgealpa
Dullingari
Orientos
miles 100
LOCATION MAP