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RECORDS:

1966/134

CONTRIBUTIONS TO THE PALYNOLOGY OF THE PERMIAN & TRIASSIC OF THE BOWEN BASIN

by

P.R. Evans

15928/65

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CONTENTS

ABSTRACT

Thirty two samples from outcrops and shallow drill holes, mainly in the Blackwater Group and Rewan Formation of the central Bowen Basin have been examined for their microfloral content, and dated in terms of the late Permian - early Triassic palynological sequence of the southern Bowen Basin. The Blair Athol Coal Measures are tentatively allocated to the Lower Permian Unit P3a, comparable in age to the Collinsville Coal Measures. The German Creek and Elphinstone Coal Measures are undated. The Rangal Coal Measures range from ?Unit P3d to P4 and possibly to Trla. The basal Triassic units Trla and Trlb are represented in the Sagittarius Member of the Rewan Formation. Unit Trla is characterized by recycled Lower Permian spores and pollen grains, thought to be an expression of rejuvenation of the Bowen Basin at the beginning of the Triassic. Nothing younger than Unit Trlb has yet been sampled in the Rewan Formation to the east of Blackwater. The Lower Triassic Unit Tr2a is represented east of the Carborough Range. Carbonization of the observed microfossils varied, the appearance of grains apparently depending on their pteridophytic or gymnospermous origins.

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INTRODUCTION

The geological history of the Bowen Basin in eastern - central Queensland is currently being studied by the Bureau of Mineral Resources and Geological Survey of Queensland. As part of this survey, an investigation of the late Permian Blackwater Group is in progress (Jensen & Arman, 1966).

A.R.Jensen collected in 1965 samples from the Blackwater Group and Rewan Formation for microfloral analysis aimed at determination of their geological ages. The present report includes the initial results of this analysis. A more comprehensive report of the results will be compiled after examination of samples from the 1966 programme of field work and test drilling has been completed.

Age determinations are discussed in terms of palynostratigraphic units recognized in the southern Bowen Basin (Evans, 1964, 1966). The problem of spore carbonization, initially considered in relation to the late Permian and Triassic of the Bowen Basin (Evans, 1963) is briefly raised again.

LOCATION OF SAMPLES

A sketch map of the Bowen Basin, showing the approximate localities of the samples examined is presented in textfigure 1. Most of the material came from shallow holes drilled by Utah Development Corporation in the Blackwater region. The Utah holes and the BMR seismic survey holes to the east of Blackwater, which were previously studied by Evans (1963), and which have been re-examined for this project, are plotted in textfigure 2*. Their locations are detailed in order of map sheet number and field number in Table 1.

OBSERVATIONS

Except for the contents of sample C73, the observed spores, pollen grains and microplankton are listed in Table 2, where they are arranged in order of first appearance and apparent range against the samples in order of location, age and field number. Barren samples are also listed. Details of the formations from which they were taken are to be found in Jensen and Arman (1966).

Outcrop samples, with the exception of C16 from the open cut at Blair Athol, failed to yield any plant microfossils.

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* Based on the geological map of the Duaringa 1:250,000 Sheet area, BMR 1965 Preliminary Edition.

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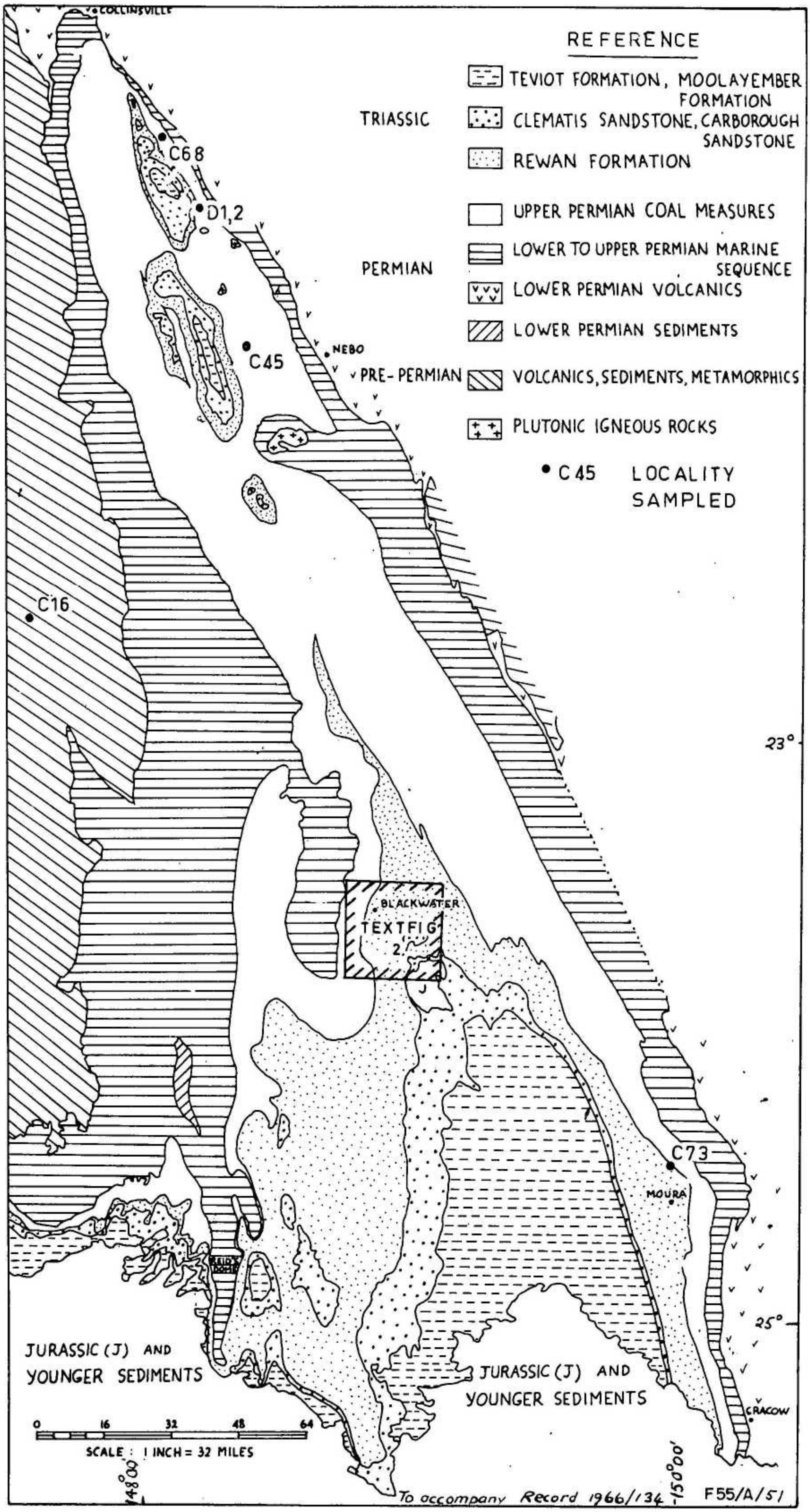
Blair Athol Coal Measures.

The Blair Athol Coal Measures were recently described by Veevers et al. (1964). Denmead (in Hill & Denmead, 1960, p223) noted that, "The spores of its coal seams suggest correlation with the upper Bowen Coal Measures". De Jersey (1964) listed spores and pollen grains from Blair Athol on which Denmead's comment was presumably based, but remarked that the determination of the coals' age is not so well established as those of other coals discussed in his report. De Jersey listed an assemblage from Blair Athol in terms of a code nomenclature which was originally employed by Dulhunty (1945, 1946) for Permian microfloras in coals of the Sydney Basin. Balme & Hennelly (1955, 1956a,b) formally named about half of these types so that the assemblage could read:

De Jersey	Balme & Hennelly	BMR No.
P1A	Leiotriletes directus	207
P3A	Cycadopites (al. Entylissa) vetus	
P4d	Retusotriletes (al. Calamospora) diversiformis	6
P5C	Pilasporites plurigenus	
P6A	Granulatisporites trisinus	
P8A	Marsupipollenites triradiatus	152
P16A	Anapiculatisporites (al. Apiculatisporites) ericianus	
P26A	Granulatisporites micronodosus	111
P29A (in part)	Verrucosisporites parmatus	
P38A	Protohaploxypinus (al. Lueckisporites) amplus	147
P40D	Striatoabietites (al. Lueckisporites) multistriatus	150

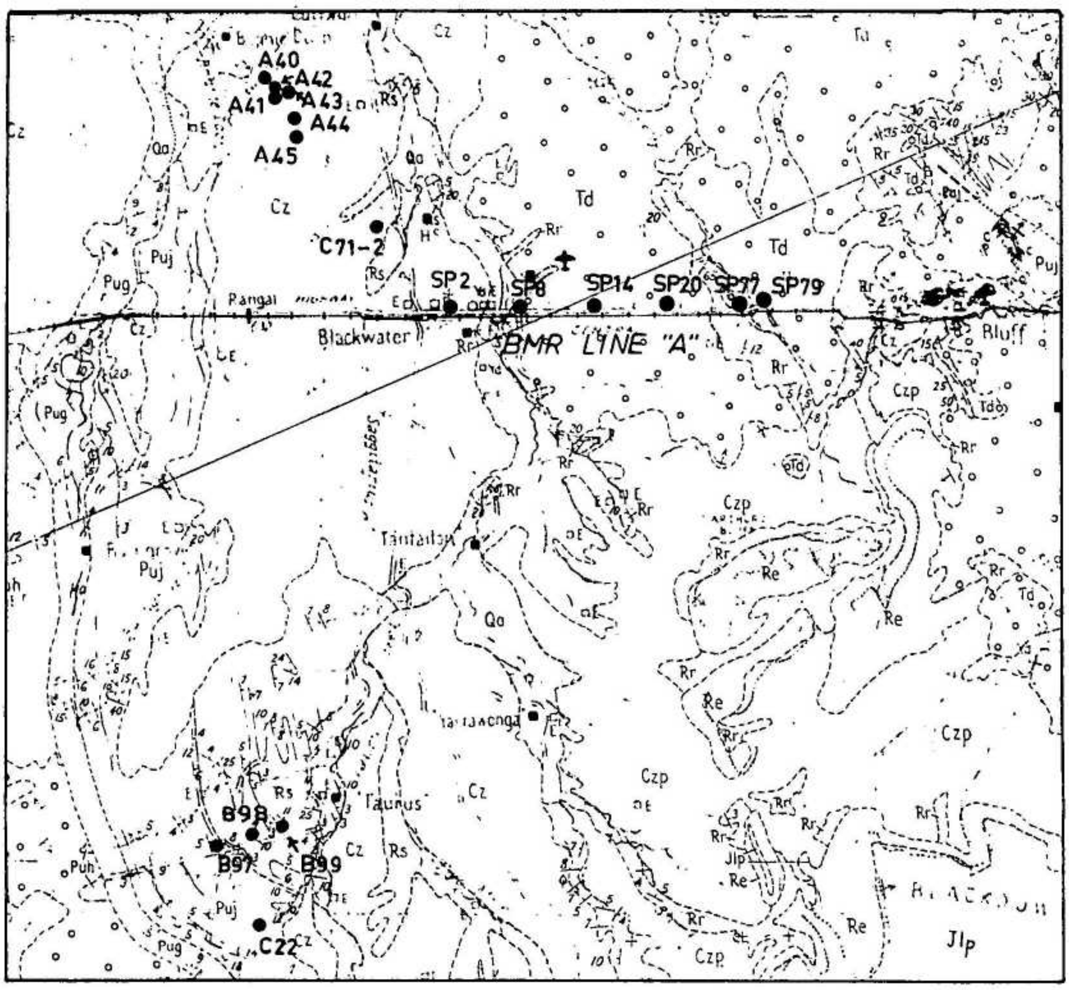
De Jersey based his determination of the age of the Blair Athol Coal Measures on the association of type P40A (not formally named but confined, according to Dulhunty, to the Newcastle and Tomago Coal Measures in the Sydney Basin), with type P29A (Greta and Newcastle, not Tomago) and the apparent absence of type P33A (a Tomago type). With insufficient information about types P40A and P33A, this proposition cannot be confirmed. Balme & Hennelly thought that P29A of de Jersey was in part synonymous with Verrucosisporites parmatus, which occurred only in the Greta Coal Measures of the Sydney Basin. There is no way of telling whether Balme & Hennelly were referring to the Blair Athol specimens.

SAMPLE LOCALITIES ; BOWEN BASIN



opp P.2

LOCATION MAP: BLACKWATER AREA



REFERENCE

SCALE

0 — 5 — 10

Miles

● C22 Sample Locality

JURASSIC

Precipice Sandstone	Jlp	Quartz sandstone, cross-bedded, pebbly

TRIASSIC

Mimosa Group			
	Clematis Sandstone	Re	Quartz sandstone, cross-bedded, fine to coarse grained; some siltstone interbeds
	Rewan Formation	Rr	Red, buff, and grey-green mudstone, with interbeds of green lithic sandstone
	Sagittarius Sandstone Member	Rs	Green feldspathic and lithic sandstone with red and green mudstone interbeds

PERMIAN

Blackwater Group			
	Undifferentiated	Puw	Lithic and feldspathic sandstone, calcareous in places, siltstone, mudstone, carbonaceous mudstone, coal, limestone, tuff, white and green ashstone with abundant plant fossils
	Rangal Coal Measures	Puj	Carbonaceous mudstone, coal, siltstone, feldspathic and lithic sandstone, calcareous in places, white ashstone
	Burngrove Formation	Pug	Green ashstone and siliceous siltstone, dark carbonaceous mudstone, thinly interbedded mudstone and fine lithic sandstone, calcareous lithic and feldspathic sandstone
	Fair Hill Formation	Puh	Labile sandstone, calcareous in places with horizons of discoidal calcareous concretions, tuffaceous sandstone and conglomerate, mudstone

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TABLE 2: MICROFLORAL DISTRIBUTION CHART

MICROFLORA	SAMPLE	Tr2a	Tr1b	Tr1(?a)	P4	P4	Tr1b	Tr1b	Tr1b	Tr1(?a)	P4	P4	P4	P4	P4	P4	P4	P4	P4	P3d/P4	P2/P3a
MFP		3920	3916	3913	3910	3915	2088	2087	2083	3918	3940	3941	3939	3931	3932	3929	3930	3914	3927	3928	3909
FIELD NO.		D 2	B99	B98	C22	B97	SP79	SP77	SP 2	C72	A45	"	A44	A43	"	A42	"	A41	A40	"	C16
Retusotriletes diversiformis	6			+																	+
Conbaculatisporites sp.	112																				cf
Polypodiidites cicatricosus	134																				af
Alisporites sp.	140																				af
Striatoabietites cf. S. multistriatus	150													+						(?)	+
Acanthotriletes tereteangulatus	113				+	+							+	+			+	+	+	(+)	+
Granulatisporites sp.	110				+	+						+		+			+	cf			+
Anapiculatisporites sp.	117										+					+					cf
Vesicaspora ovata	138					+				+	+	+	C	(C)				cf			cf
Marsupipollenites triradiatus	152									cf	?				fc	(?)					+
Leiotriletes directus	207		cf	+		+				cf						+		+	+	fc	C
Microreticulatisporites bitriangularis	121																			(+)	
Dulhuntyispora parvithola	123																			(+)	
Kraeuselisporites apiculatus	127				+															(+)	
Apiculatisporis sp.	616																			+	
Acritarcha sp.	625																			(+)	
Striatopodocarpites cancellatus	143			+	+	+												af		+	
Vitreisporites cf. V. pallidus	135			+		cf										+		cf		(C)	
Disaccites	137				cf										C					(+)	
Striatoabietites sp.	209			af						cf										+	
Granulatisporites micronodosus	111																		af		
Disaccites spp. undiff.																		fc	C		
Baculatisporites sp.	109				cf	+												+	+		
Protohaploxypinus amplus	147					fc					+	+	C	(C)	(+)		cf	+			
Apiculatisporis sp.	614															+					
Striatiti spp. undiff.															C						
Lophotriletes sp.	612														+						
Striatopodocarpites sp.	210				C	fc															
Monosaccites sp.	157									(cf)											
Cyathidites sp.	218	+								(+)											
Apiculatisporis sp.	226		+	+						+											
Alisporites sp.	279			+						+											
Reticulatisporites sp.	620									+											
Anapiculatisporites sp.	617								af	+											
Kraeuselisporites sp.	623		+						+	(+)											
Kraeuselisporites sp.	36			?																	
Parasaccites sp.	52			+																	
Protohaploxypinus cf. P. limpidus	146			+																	
Micrhystridium sp.	269			+																	
Granulatisporites sp.	347			af																	
Veryhachium sp.	361			(+)																	
Perinotrilliti sp.	624			+																	
Micrhystridium sp.	626			+																	
Platysaccus queenslandi	278	+		cf																	
Apiculati sp.	231							+	+												
Striatiti sp.	260		+				+	+	+	(+)											
Alisporites sp.	277	+	+				+	+	+												
Discisporites sp.	241							+													
"Trizonaesporites" sp.	258							+													
Striatiti sp.	84	cf						cf													
Todisporites sp.	219	+						+													
"Nuskoisporites" radiatus	257		+	+				+		(+)											
Polypodiidites sp.	254	+					+	+													
Distalanulisporites sp.	242	+					+	+													
Kraeuselisporites sp.	246						+														
Lundbladispora brevicula	353			af			C														
Laevigatosporites vulgaris	132					+															
Limitisporites sp.	142					+															
Calamospora sp.	609					+															
Apiculati sp.	611					+															
Apiculatisporis sp.	613					+															
Anapiculatisporites sp.	615					+															
Murornati sp.	619					+															
Murornati sp.	621					+															
aff. Gnetaceaepollenites sp.	208		+																		
Tigrisporites sp.	239		+																		
Laevigati sp.	610		+																		
Anapiculatisporites sp.	622		+																		
Densoisporites playfordi	243	+																			
Taeniaesporites sp.	368	+																			
Apiculati sp.	369	+																			
Apiculati sp.	618	+																			

(+) - illustrated
C - common
fc - fairly common
+ - present
cf - compare
af - affinities with

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However, V. parmatus has been observed in Queensland, restricted to P1c - P2 horizons (Evans, in Mines Administration Pty. Ltd, 1962) and not yet recorded from younger beds.

Malone (1964) on the other hand acknowledged the spore evidence, but noted that the Blair Athol Coal Measures "...occupy a position relative to the Denison Trough similar to that occupied by the Collinsville Coal Measures relative to the northern trough. The Blair Athol Coal Measures are possibly the same age as Unit B...". (Unit B = Gebbie Subgroup of the Back Creek Group).

Sample C16 from the Blair Athol open cut contained an abundant microflora mixed with much vegetative tissue. The proportion of spores to pollen grains was high, Leiotriletes directus (sp.207) being the most prominent. Most of the disaccate grains are indeterminate, but few are striate. This is a great contrast to the major content of striate disaccate grains (Striatiti spp.) characteristic of Units P3b - P4, particularly of Unit P4. However, a grain similar to Polypodidiites cicatricosus (sp.134) was found. P. cicatricosus has a known range of P1c - P3a. A P1c age for sample C16 is discounted because of an apparent lack of monosaccate grains of the Parasaccites type. De Jersey's record of type P16A = Anapiculatisporites ericianus (Balme & Hennelly) may be of significance since A. ericianus is not known below Unit P3a.

The Blair Athol Coal Measures may therefore be of Unit P3a age, comparable with the Aldebaran Sandstone of the Denison Trough, and the Collinsville Coal Measures, as surmised by Malone. However, better representative assemblages accurately located against the rock sequence are needed for confidence in this determination.

Elphinstone & German Creek Coal Measures

No spore or pollen grain bearing sample of the Elphinstone and German Creek Coal Measures has yet been found. Those supplied were only from outcrop and drilled samples have yet to be obtained.

Rangal Coal Measures

Sample A40 at 140-150 feet is perhaps the oldest in the sequence. Compared with the other samples it contains a larger variety of spores, including Dulhuntyispora parvithola (Balme & Hennelly) (sp.123), Microreticulatisporites bitriangularis B & H. (sp.121), and Kraeuselisporites apiculatus Pocock (sp. 127), specimens of which are illustrated in Plate 1.

Such variety is more akin to Unit P3d, rather than P4, but without the key acritarchs, this indication of the sample's age cannot be confirmed. A microfossil regarded as an acritarch, Acritarcha sp.625 (Plate 2, figure 3) was detected in the sample. It is a form of unknown affinity, which usually occurs in small numbers throughout Units P3b - P3d, but no environmental significance is attributable to its occurrence. Although only found as separate hemispheres, it may originally have been a sphere with an equatorial suture. Each hemisphere is ornamented with three concentric walls on which small spines are developed. Such concentrically arranged walls on a hemispherical membrane is a basically similar structure to that of the acritarch (Norris & Sarjeant, 1965) Circulisporites parvus de Jersey, which was recently reillustrated by Hill et al. (1965, Plate TXI, figure 18) as comprised of two hemispherical membranes, and which, by its varied loci of occurrence is not regarded as a facies indicator.

No stratigraphic distinction is made between samples A41 - A44. All are fossiliferous: spores are rare, but the samples are characterized by relatively abundant Striatiti spp. with Vitreisporites cf. V. pallidus (sp.135) (Plate 2, figure 6) and/or Vesicaspora ovata (sp.138) (Plate 1, figure 6).

Rangal Coal Measures/Sagittarius Member of the Rewan Formation

The position of a number of samples relative to the Rangal Coal Measures/Rewan Formation boundary is uncertain. Of those north of the railway line in the Blackwater area, C71 was thought to be of the Sagittarius Member, but unfortunately it was barren. The lower sample from the same hole, C72, thought to be of Rangal Coal Measures, contained abundant but severely carbonized grains. Among those identified, Striatoabietites sp.209, cf. Marsupipollenites triradiatus (sp. 152), Vesicaspora ovata (sp.138) are characteristic of Permian sections, but Cyathidites sp.218 (Plate 1, figure 10), Apiculatisporis sp.226, "Nuskoisporites" radiatus (sp.257) (Plate 2, figure 9) Striatiti sp. 260, (Plate 2, figure 1) Kraeuselisporites sp.623 (Plate 1, figure 8) are to be found in Triassic levels. The association of cf. M. triradiatus (sp.152), and "N". radiatus (sp.257) suggests that sample C 72 is of basal Lower Triassic Unit Trla age. However, the characteristically abundant component of Trla is the southern Bowen Basin, Quadrisporites horridus (sp.211) could not be found. Monosaccites cf. sp. 157 (Plate 1, figure 9) is of interest as the species with which it is compared is characteristic of the Lower Permian Unit Plc.

Its presence is in keeping with records of other pre-Triassic species from Unit Tr1a, which, in view of the assemblages in C12 and B98 (see below), might be reworked.

The depths of samples collected from boreholes south of the railway line through Blackwater were not accurately recorded and could range over intervals of at least 200 feet. However, they show a similar sequence to the northern collections. Samples B97 and C22 contained fairly typical P4 assemblages of common striate and non-striate disaccate pollen grains. B97 was unusual in including new species of verrucate, rugulate and monolete spores, and was unique to the area with a content of Laevigatosporites vulgaris (sp.132), a normal component of Unit P4 in the southern Bowen Basin. The P4 age of sample C22, taken from above the main coal seam, indicates that the top of this coal cannot be conveniently regarded as equivalent to the Permian/Triassic boundary.

Sample B98 is presumed to be next in stratigraphic sequence. The association of Striatopodocarpites cancellatus (sp.143) and aff. Striatoabietites sp.209 with "Nuskoisporites" radiatus (sp.257), Apiculatisporis sp.226 and Alisporites 279 suggests a Unit Tr1a age. There is again no sign of Quadrisporites horridus. B98 also contained Parasaccites sp.52 (common in the Upper Carboniferous - Permian units C1 - P1c) and a possible Kraeuselisporites sp.36 (thought to be restricted to Units C1 - C2). The presence of such apparently older species is typical of Unit Tr1a at Reid's Dome and Arcadia, and now at Blackwater. It strongly suggests, not so much a brief re-establishment of an old flora, but a phase of spore recycling due to changes in base level, which terminated deposition of the extensive late Permian Coal Measures, and erosion of areas, probably to the west, where the late Carboniferous and early Permian Joe Joe Formation and Reid's Dome Beds were exposed.

Sample B98 is also remarkable for a content or rare acritarchs, Micrhystridium sp.269, Veryhachium sp. 361 (Plate 2, figure 2) and Micrhystridium sp.626. (In view of the preceding discussion, the possibility that these acritarchs were also recycled must not be overlooked. However, M. sp269 was previously observed in Units Tr1b - Tr3 and V. sp. 361 in both Permian and Lower Triassic sediments, and they could well be indigenous to the horizon of sample B98.

Sample B99 contained a typical Unit Tr1b assemblage, with aff. "Gnetaceaepollenites" sp. 208, Tigrisporites sp.239, "Nuskoisporites" radiatus (sp. 257), Striatiti sp. 260, Alisporites sp. 277 and much vegetative debris. There was no sign of Q. horridus.

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Rewan Formation

Only sample SP2 150-175 feet may be confidently thought to have come from the Sagittarius Sandstone Member of the Rewan Formation. The residue was carbonized and the grains abundant but corroded, indicative of Unit Tr1b. Saccate grains such as Striatiti sp. 260, Striatiti sp. 263 and Alisporites sp. 277 were dominant.

SP77, 70-80 feet, from the Rewan Formation above the Sagittarius Sandstone Member, gave a similarly abundant, varied, but carbonized Tr1b assemblage with many saccate grains. In contrast, SP 79, 70-80 feet contained mainly cingulate grains.

Sample D2, from Rewan Formation to the east of the Carborough Range, is the youngest examined, referable to Unit Tr2a, because of its content of Densoisporites playfordi (sp.243) and Taeniaesporites sp. 368.

Gyranda Formation

Sample C73, from the Gyranda Formation in the Monto Sheet area, yielded the following, poorly preserved species.

Kraeuselisporites apiculatus (sp.127) (Plate 1, figure 4)
Acanthotriletes tereteangulatus (sp.113)
Vitreisporites cf. V. pallidus (sp. 135)
Alisporites sp. 137
Protohaploxypinus amplus (sp.147)(fairly common)
Limitisporites sp.142
Striatoabietites sp. 209

This is insufficient evidence with which to determine the age of the sample to a greater accuracy than within the range of Units P3b - P4.

CARBONIZATION

All the fossiliferous Permian and most of the Triassic samples yielded badly preserved, strongly carbonized spores and pollen grains.

A factor common to samples A40 to A44 from the Rangal Coal Measures is the apparent improvement in preservation with depth. Grains from A40, at 150-160 feet (MFP 3928) are badly carbonized, but recognizable. In contrast, the residue from the stratigraphically higher sample at 50-60 feet is so poorly preserved, that most fossils are fragmented, and the saccate grains are so corroded that it is impossible to detect the cap ornament. One of the very few complete specimens is illustrated in Plate 1, figure 3. The residue from A41 included relatively abundant Striatiti spp. but all were heavily carbonized and fragmented. Carbonization was very advanced in sample A42, 130-140 feet, in which only three fossil types could be identified. Preservation was no better in the higher sample from 50-60 feet. Sample A43, 150-160 feet, contained an abundant, carbonized, but recognizable microflora comprising a typical Unit P4 assemblange, but sample A43 at 50-60 feet presented a moderately abundant microflora of entire but corroded specimens. Sample A44 at 160-167 feet yielded abundant, but extremely poorly preserved fossils, but at 40-50 feet yielded only woody tissue.

The state of preservation of the collections from south of the railway is no improvement on that of assemblages from the north.

This aspect of spore preservation may be a reflection, not of a reversed carbonization sequence, but of the influence of weathering on already carbonized tissues. Samples were chosen for analysis from each borehole, following the customary practice, on the basis of colour, in order to obtain the microfloras from immediately below the weathered zone in each hole. Where carbonization is advanced, most carbonaceous sediments take on a steely grey colour, which in several cases may be giving a mistaken impression of an unweathered state: the apparently fresh, but microflorally barren outcrop samples C1, C5 and C68 may be examples of such a position. The influence of weathering, by oxidation as opposed to carbonization, may have penetrated to deeper levels in the bored sections than initially supposed. Evans (1963) suggested that fragmentation of carbonized spores may occur during the extraction process on account of the loss of mechanical strength during carbonization, which results in the grains' incapacity to withstand centrifuging etc. This condition may be further aggravated by the weathering process. In future, samples from immediately below the apparent base of the weathering zone should be avoided if severe regional carbonization is known to have taken place.

The extent to which carbonization affects some of the microfossils in the Bowen Basin is illustrated in Plates 1 and 2. Pteridophytic spores such as Dulhuntyispora parvithola (Balme & Hennelly) and Cyathidites sp. 218 with relatively thick exines are so carbonized that they are almost opaque to transmitted light (Plat 1, figures 1 & 10). The illustration of D. parvithola was taken with a deep red filter in the light train, but even this arrangement was insufficient to produce a satisfactory image of the wall structure. The thinner walled Acanthotriletes tereteangulatus B. & H. on the other hand (Plate 2, figure 3) is still sufficiently translucent for a photographic image to be obtained without the use of filters and its processes are entire.

The exines of gymnospermous pollen grains are affected differently. Disaccites sp.137 (Plate 1, figure 5), from one of the least affected samples of Rangal Coal Measures, A40, 140-150 feet, although coloured brown, retained the intrareticulum of its sacci. However, specimens of Protohaploxypinus amplus (B & H.) (sp. 147) (Plate 2, figures 4 and 5) from the Rangal Coal Measures at A43 have degenerated into pieces of irregular tissue with little sign of the species' characteristic body striae and saccus intereticulum (cf. Balme & Hennelly, 1956a, Plate 3, figures 24 - 28). These specimens were only identified as P. amplus by their outline and the shapes and relative sizes of the body and sacci, and, in the case of Plate 2, figure 4, by a slight impression of body striae. Striae are more readily discernable in Striatoabiatites sp. (Plate 2, figures 8), but they do not extend over the full width of the proximal cap as one might expect them to do.

Elongate monsaccate grains, such as Monosaccites sp. 157 and Striati sp.260 (Plate 1, figure 9; Plate 2, figure 1) degenerate in a similar manner.

Unlike the single layered walls of spores, but like the multi-layered exines of saccate grains, the wall of the monocolpate Marsupipollenties triradiatus B & H. becomes irregularly thickened when carbonized (Plate 2, figure 7).

CONCLUSIONS

The late Permian - early Triassic spore/pollen sequence of the southern Bowen Basin is recognizable in central and northern areas of the Basin.

Assemblages of Unit P4 are dominated by disaccate pollen grains, irrespective of the containing rocks (coals or clastics). A statistical study of the ratios of types of saccate pollen grains to each other and to the total spore content may be of value to future work in this unit.

The Blair Athol Coal Measures appear to be of Lower Permian, Unit P3a age, not late Permian age as previously supposed.

No direct evidence of the palynological unit equivalent to the German Creek and Elphinstone Coal Measures is yet available.

The Rangal Coal Measures are in part at least of Unit P4 age. They may be as old as Unit P3d towards the base.

The Permian/Triassic boundary may occur within the Rangal Coal Measures or within and near to the base of the Sagittarius Sandstone Member of the Rewan Formation. The lithostratigraphic position of sample C22, of P4 age, but from above the main coal seam, is critical to this problem.

The presence of two locations with Trl (?a) assemblages suggests that a more complete sedimentary sequence is present in the Blackwater area than in the southern Bowen Basin, where Trla is confined below the Brumby Sandstone Member of the Rewan Formation and is cut out in places by an unconformity.

Unit Trla is notable for a content of (?) recycled grains of Units Cl - Plc age. Their presence may reflect movements which initiated further downwarp of the Bowen Basin at the commencement of the Triassic, after the relatively quiescent period of coal measure deposition in late Permian times.

Ephemeral brackish or marine conditions of deposition may have spread into the Blackwater region in Unit Trla times, but the few acritarchs present, on which this suggestion is based, could have been recycled.

There is a curious lack of <u>Quadrisporites horridus</u> in Units Trla - b in the Blackwater region, compared with its abundance in the southern Bowen Basin.

The Rewan Formation to the east of Blackwater is of Unit Trlb age. However, the upper palyno-age limit of the formation in that area is unknown.

The existence of Lower Triassic deposits to the east of the Carborough Range is confirmed. The horizon sampled is of Tr2a age, and representation of the older Trlb should be sought.

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The generally poor preservation of the spores in both Permian and Triassic sediments in the Blackwater area is consistent with previous observations. Of the samples submitted, the best preserved spores come from Blair Athol, the next from A40, 140-150 feet. Carbonization appears to corrode the outer exinal layer of gymnospermous pollen grains in a different manner to the walls of pteridophytic spores.

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EXPLANATION OF PLATES.

All magnifications 600x

FIGURE	SPECIES	NO.	SAMPLE/SLIDE	CO-ORDS.*
	PLATE 1.			
1	Dulhuntyispora parvithola	123	3928.1	080.089
2	Microreticulatisporites bitriangularis	121	3928.1	021.010
3	Acanthotriletes tereteangulatus	113	3927.1	138.168
4	Kraeuselisporites apiculatus	127	3912.2	058.147
5	Disaccites sp.	137	3928.1	014.069
6	Vesicaspora ovata	138	3931.1	101.103
7	Kraeuselisporites apiculatus	127	3928.1	014.064
8	Kraeuselisporites sp.	623	3918.1	150.085
9	cf. Monosaccites sp.	157	3918.1	128.136
10	Cyathidites sp.	218	3918.1	097.128
	PLATE 2			
1	Striatiti sp.	260	3918.2	041.189
2	Veryhachium sp	361	3913.2	111.041
3	Acritarcha sp.	625	3928.1	126.024
4	Protohaploxypinus amplus	147	3931.1	051.143
5	?Protohaploxypinus amplus	147	3932.1	102.146
6	Vitreisporites sp.cf. V. pallidus	135	3928.1	038.017
7	?Marsupipollenites triradiatus	152	3929.2	140.171
8	Striatoabietites sp.		3928.1	055.129
9	"Nuskoisporites" radiatus	257	3918.1	063.036

* Reduced to standard reference point for each slide.

To accompany Records 1966/134

TABLE 1: SAMPLE LOCATIONS & HORIZONS

1:250,000 SHEET		FIELD NO.	PALYN.LAB. NO.(MFP)	BORE CO.	BORE NO.	BORE DEPTH	CO-ORDINATES E	CO-ORDINATES N	BMR REG. NO.	FORMATION
Mount Coolon	SF55-7	C45	3917*	Outcrop			665600	229675	65010345	Elphinstone Coal Measures
"	"	C68	3911*	"			639500	237305	65010368	" " "
"	"	D1	3919*	Thiess	?	?	650600	2351900	65010401	Sagittarius Memb. equivalent
"	"	D2	3920	"	?	?	650400	2351600	65010402	? Rewan Formation
Clermont	SF55-11	C16	3909	Outcrop			573400	2167800	65010316	Blair Athol Coal Measures
St Lawrence	SF55-12	C12	3908*	"			124900	2135800	65010312	German Creek Coal Measures
Duaringa	SF55-16	A40	3927	Utah	5002	50- 60'	157900	2067700	65010140	Rangal Coal Measures
"	"	"	3928	"	"	140-150'	"	"	"	" " "
"	"	A41	3914	"	5003	10-168'	158100	2067500	65010141	? " " "
"	"	A42	3929	"	5004	50- 60'	158300	2067200	65010142	" " "
"	"	"	3930	"	"	130-140'	"	"	"	" " "
"	"	A43	3931	"	5005	50- 60'	158500	2067000	65010143	" " "
"	"	"	3932	"	"	150-160'	"	"	"	" " "
"	"	A44	3938*	"	5006	45- 50'	158800	2066700	65010144	? " " "
"	"	"	3939	"	"	160-167'	"	"	"	? " " "
"	"	A45	3940	"	5009	40- 50'	159100	2066400	65010145	" " "
"	"	"	3941	"	"	130-140'	"	"	"	" " "
"	"	B97	3915	"	6	0-250'	156480	2041050	65010297	" " "
"	"	B98	3913	"	7	0-200'	157300	2041000	65010298	Rangal C.M./Sagittarius Memb.
"	"	B99	3916	"	129	0-218'	159250	2041350	65010299	" " "
"	"	C1	3921*	Outcrop			145000	2058600	65010301	German Creek Coal Measures
"	"	C5	3922*	"			144300	2058700	65010305	" " " "
"	"	C22	3910	Utah	949	60'	158200	2038150	65010322	Rangal C.M./Sagittarius Memb.+
"	"	C71	3923*	"	5015	?	161750	2063700	65010371	? Sagittarius Member
"	"	C72	3918	"	"	?	"	"	65010372	Rangal Coal Measures
"	"		2083	BMR	SP 2	150-175'	(See Robertson, 1961, Pl.2)			? Sagittarius Member
"	"		2084*	"	SP 8	80- 96'	"	"	"	Rewan Formation
"	"		2085*	"	SP14	80- 96'	"	"	"	" "
"	"		2086*	"	SP20	80- 96'	"	"	"	" "
"	"		2087	"	SP77	70- 80'	"	"	"	" "
"	"		2088	"	SP79	70- 80'	"	"	"	" "
Monto	SG56- 1	C73	3912	?	?	420'	?	?	65010373	Gyranda Formation

* Barren sample. + Cuttings from above the main coal.

F55/A/53

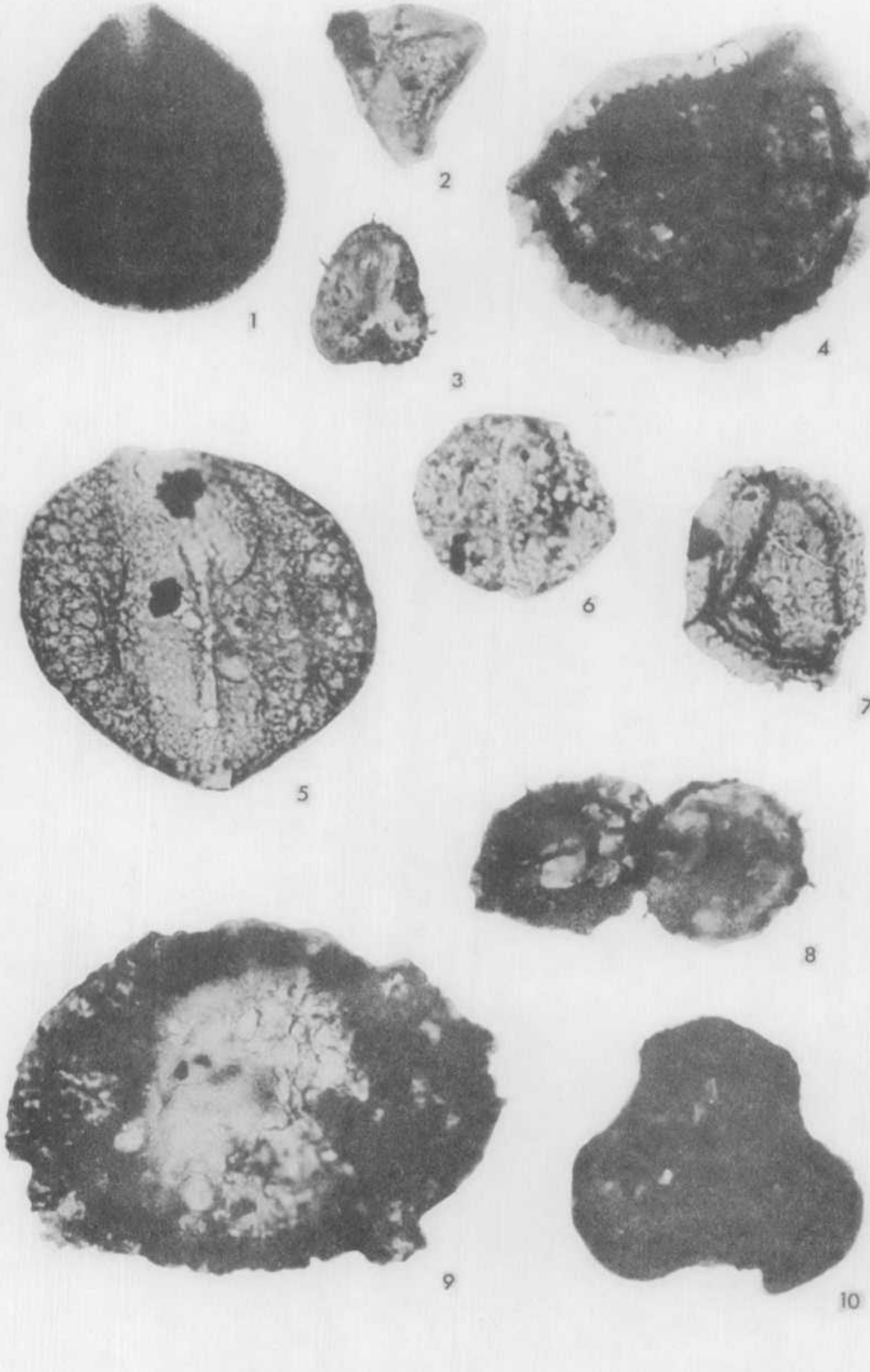

PLATE 1

1966/134

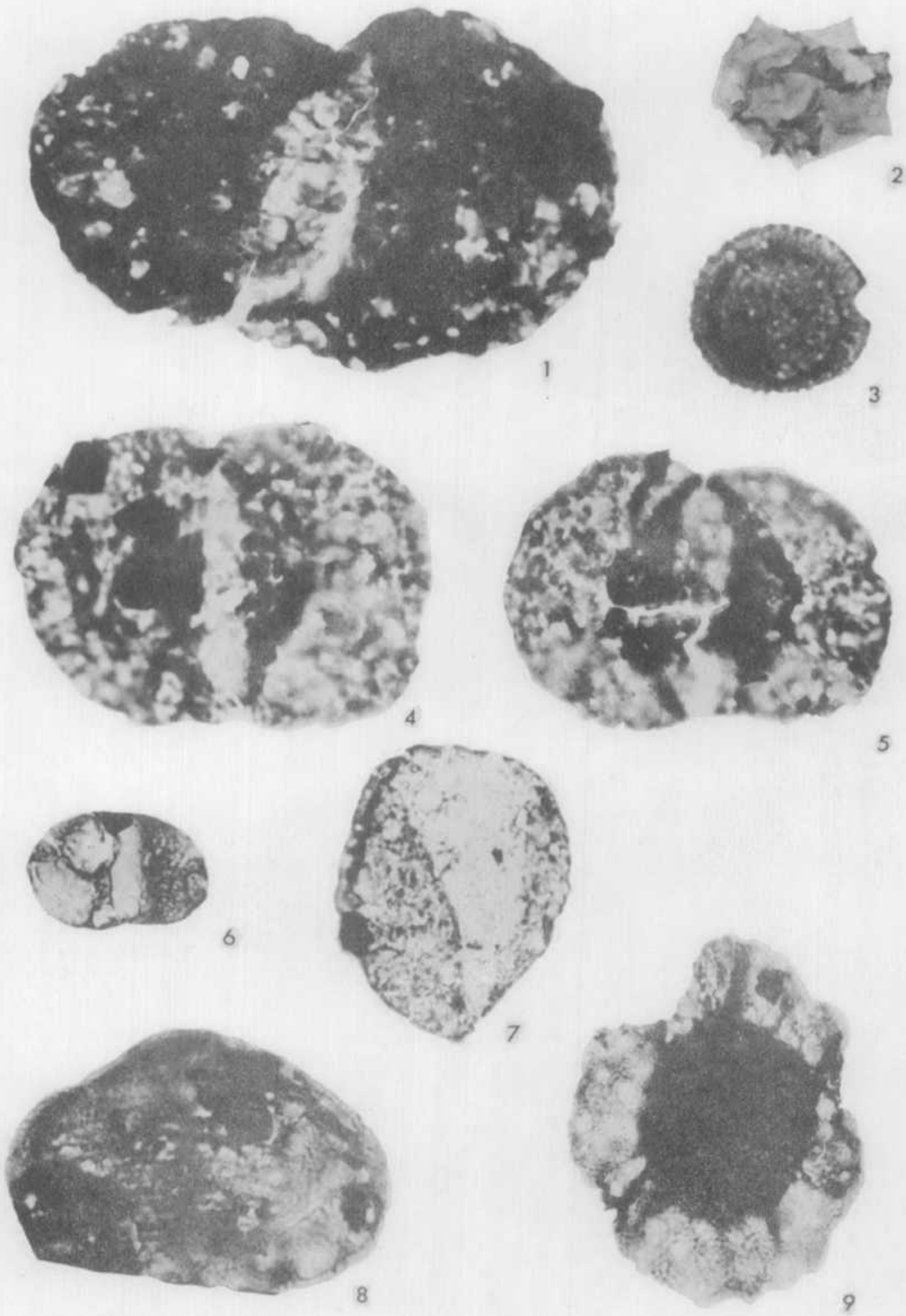

PLATE 2

1966/134