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PALYNOLOGICAL CORRELATION OF LOWER CRETACEOUS SEDIMENTS IN

WOOLSTHORPE No.1, GARVOC No.1, AND PURRUMBETE No.1

WELLS

Three reports recently submitted to Shell Development (Australia) Pty. Ltd. contain results of microfloral studies on sediments in Woolsthorpe No.1, Garvoc No.1, and Purrumbete No.1 wells (Dettmann 1968a,b,c). In these reports microfloras obtained from all samples studied are documented in detail, and the ages of the individual spore-pollen suites are discussed. The samples investigated were shown to be mostly, if not all, of Lower Cretaceous age, and the three well sequences were subdivided in terms of the spore-pollen zones of Dettmann and Playford (1968). The zones recognized in the sequences include: the Middle-Upper Albian Coptospora paradoxa Zone; the Lower Albian Crybelosporites striatus Subzone of the Dictyosporites speciosus Zone; the Neocomian-Aptian Cyclosporites hughesi Subzone of the D. speciosus Zone; and possibly the ?uppermost Jurassic - lowermost Cretaceous Crybelosporites stylosus Zone.

The purpose of the present report is to discuss more fully the palynological contents of the spore-pollen zones recognized within the wells, and to outline a palynologically-based method by which the Cyclosporites hughesi Subzone and the Coptospora paradoxa Zone may be further subdivided. The vertical distribution of the biostratigraphic units thus recognized in each well sequence is recorded, and correlations of the sequences are illustrated in Figure 1. Comments on the distribution of the spore-pollen zones in F.B.H. Pretty Hill No.1 and F.B.H. Eumeralla No.1 wells are also included.

## THE SPORE-POLLEN ZONES

### The Crybelosporites stylosus Zone

Sediments containing spore-pollen suites referable to the Stylosus Assemblage of Dettmann (1963a) are referred to the Crybelosporites stylosus Zone of ?uppermost Jurassic - lowermost Cretaceous age (Dettmann and Playford 1968). In the Otway Basin, sediments comprising this zone appear to be of limited distribution and are best known in Penola No.1 well, 4766-76 feet (Dettmann 1963a). The zone is probably developed in Woolsthorpe No.1 well at 6380 feet, although only doubtful specimens of the index species, Crybelosporites stylosus, were recovered (Dettmann 1968a). The zone has not been recognized in Garvoc No.1 or Purrumbete No.1 wells (Dettmann 1968b,c).

### The Cyclosporites hughesi Subzone of the Dictyotosporites speciosus Zone

Sediments comprising this subzone contain microfloras diagnostic of the older category of Dettmann's (1963a) Speciosus Assemblage, which is recognized by the association of Dictyotosporites speciosus and Cyclosporites hughesi and lack of Crybelosporites stylosus. The subzone is considered to be of Neocomian-Aptian age (Evans and Hawkins 1967). It occurs over wide areas of the Otway Basin and has been recognized in Woolsthorpe No.1, Garvoc No.1, and Purrumbete No.1 wells as follows:

Woolsthorpe No.1 well, 4300 - 6250 feet (cf. Dettmann 1963a).

The assignment of the deposit at 4300 feet to the subzone is based upon a study of additional palynological residue in which Cyclosporites hughesi and Cooksonites variabilis were identified.

Garvoc No.1 well, 3549 - 4964 feet (Dettmann 1968b).

Purrumbete No.1 well, 4220 - 5925 feet with a possible extension to 3830 feet (cf. Dettmann 1968c). A further study of the sample at 3710 feet indicates that it is from the succeeding Crybelosporites striatus Subzone (see below).

Three, distinct, successive microfloral suites are recognizable within sediments referred to the Cyclosporites hughesi Subzone. Present records indicate that the three spore-pollen suites possess wide lateral distribution within the Otway Basin Lower Cretaceous sequence, and that their distribution is not facies controlled. The assemblages are therefore considered to provide suitable bases for biostratigraphic subdivision of sediments comprising the C. hughesi Subzone. The criteria upon which the subzone is subdivided into, what are here termed for convenience, "units" are outlined below with reference to the distribution of each "unit" in Woolsthorpe No.1, Garvoc No.1, and Purrumbete No.1 wells. The "units" are defined in order of decreasing age.

- 1) The Murospora florida "Unit" is diagnosed by the presence of Murospora florida in association with Dictyotosporites speciosus and Cyclosporites hughesi. Thus, the base of the unit immediately succeeds horizons containing the last appearances of Crybelosporites stylosus and the top contains the final occurrences of M. florida. Cooksonites variabilis is a component of the microfloras but is not restricted to the unit. The M. florida "Unit" is equivalent to the upper part of Evans's (1966) Unit K1a, and has been recognized in both eastern and western portions of the basin. It occurs in Woolsthorpe No.1, 5005 - 6230 feet and in Garvoc No.1, 4878 - 4964 feet (Dettmann 1968a,b), but has not been recognized in Purrumbete No. 1 well (Dettmann 1968c).
- 2) The Rouseisporites reticulatus "Unit" recognized at the base by the initial appearances of Rouseisporites reticulatus and the continued presence of D. speciosus, Cyclosporites hughesi, and Cooksonites variabilis. Introduction of new elements of the

succeeding unit mark the upper limit of the R. reticulatus "Unit".

Present records indicate that the R. reticulatus "Unit" is of widespread areal distribution in the Otway Basin. It has been recognized in Woolsthorpe No.1 at 4515 feet (samples at 4750 ft. and 4841 ft. did not provide diagnostic floras); Garvoc No.1, 3642 - 4489 feet (diagnostic species were not encountered in samples between 4532 - 4798 ft.); and Purumbete No.1, 5300 - 5695 feet and 75925 feet (Dettmann 1968a,b,c).

- 3) The Foraminisporis asymmetricus "Unit" defined basally by the incoming of Foraminisporis asymmetricus, and at the top by the final appearances of Cyclosporites hughesi. D. speciosus occurs throughout the unit and Cooksonites variabilis makes its last appearances in the basal part of the unit. The Foraminisporis asymmetricus "Unit" is known from numerous subsurface sections in the Otway Basin including Woolsthorpe No.1 at 4300 feet; Garvoc No.1 at 3549 feet; and Purumbete No.1, 4220 - 5070 feet, with a possible extension to 3830 feet (results based upon Dettmann 1968a,b,c and subsequent records of F. asymmetricus from 5070 feet in Purumbete No.1, and C. hughesi and C. variabilis from 4300 feet in Woolsthorpe No.1).

The Crybelosporites striatus Subzone of the Dictyosporites speciosus Zone

Microfloras diagnostic of this subzone are referable to the younger category of the Speciosus Assemblage (Dettmann 1963a). They contain D. speciosus in association with Crybelosporites striatus and lack Coptospora paradoxa, the index of the succeeding zone. In the Otway Basin, Cyclosporites hughesi makes its final appearances in horizons that are considered to represent the boundary between the C. hughesi and Crybelosporites striatus

Subzones. Burger (1968) reports a different situation in the northern Eromanga Basin where C. hughesi survives into basal horizons of the Coptospora paradoxa Zone. This evidence suggests that C. hughesi possesses a greater stratigraphical range in northern Australia, but, nevertheless, the C. striatus Subzone is still adequately distinguished by the incoming of C. striatus.

The C. striatus Subzone is of Lower Albian age (Evans and Hawkins, 1967) and is equivalent to Evans's (1966) Unit K1d. It has been recognized over wide areas of the Otway Basin and occurs in Purrumbete No.1 well, 2600 - 3710 feet with a possible extension to 2100 feet (results based upon Dettmann 1968c and subsequent record of C. striatus from 3710 feet). The subzone was not sampled in Woolsthorpe No.1 well and Garvoc No.1 well (Dettmann 1968a,b). In the latter sequence there is a distinct microfloral unconformity between 3354 feet (Coptospora paradoxa Zone) and 3549 feet (Foraminisporis asymmetricus "Unit"), and the C. striatus Subzone, if present, would only include a thin development of sediments.

#### The Coptospora paradoxa Zone

Sediments containing microfloras in which Coptospora paradoxa is a component and in which angiosperm forms referable to Tricolpites pannosus are absent are referred to the Coptospora paradoxa Zone of Middle-Upper Albian age (Dettmann and Playford 1968, Evans and Hawkins 1967). The zone is equivalent to Evans's (1966) Unit K2a and most, if not all, of his Unit K2b. The zone is of wide lateral distribution within the Otway Basin, and as outlined below basal horizons of the zone occur in Garvoc No.1 and Purrumbete No.

The microfloral sequence occurring within the C. paradoxa Zone is not considered in detail in this report. However, as noted by Evans (1966), basal horizons of the zone are distinguishable by their content of the last appearances of Dictyotosporites speciosus. This and other

criteria documented below are considered sufficient basis for preliminary subdivision of the zone.

The Dictyotosporites filiosus "Unit" contains the earliest appearances of Coptospora paradoxa and the final occurrences, <sup>cf</sup> Dictyotosporites speciosus. D. filiosus and Coptospora striata complete their ranges near the top of the unit; the former species extends down to within the Foraminisporis asymmetricus "Unit", and the latter to within the Crybelosporites striatus Subzone. The D. filiosus "Unit" is equivalent to Evans's Unit K2a and current records indicate that it comprises a thin development of sediments that occur in both eastern and western portions of the basin. It has been recognized in Garvoc No.1 well at 3534 feet and Purumbete No.1 well at 1602 feet. (Dettmann 1960b,c).

Horizons of the C. paradoxa Zone succeeding those of the D. filiosus "Unit" contain the first and continued appearances of Pilososporites grandis. Microfloras diagnostic of this, <sup>portion</sup> the bulk, of the C. paradoxa Zone were not obtained from material of the three well sections under consideration.

#### CORRELATION OF LOWER CRETACEOUS SECTIONS IN WOOLSTHORPE NO.1, GARVOC NO.1, AND PURUMBETE No.1 WELLS

Correlation of the Lower Cretaceous sediments in the three well sequences is illustrated in Fig. 1, and is based upon the vertical distribution of the various biostratigraphic units within each well sequence. The Crybelosporites striatus Subzone as recognized in Purumbete No.1 well either shows a marked reduction in thickness, or is expressed as a disconformity in Garvoc No.1 well. The Foraminisporis asymmetricus "Unit" is also of lesser development in Garvoc No.1 well as compared

to Purumbete No.1, but this may be due in part to the fact that a greater amount of sediment was deposited in the area of Purumbete No.1 during the time interval in which the F. asymmetricus "Unit" was developed.

Cretaceous sedimentation appears to have commenced earlier in Woolsthorpe No.1 than in Garvoc No.1. The complete development of the Murospora florida "Unit" in Woolsthorpe No.1 is to be compared with a thinner suite of sediments of the same unit in Garvoc No.1. Conversely, The Rouseisporites reticulatus "Unit" includes a thicker sequence in Garvoc No.1 than in Woolsthorpe No.1. No palynological disconformity was detected in Woolsthorpe No.1, but should other geological evidence point conclusively to the occurrence of a disconformity within the well, it would most likely occur in or near the base of the Rouseisporites reticulatus "Unit".

LOWER CRETACEOUS SEQUENCES IN F.B.H. PRETTY HILL No.1  
AND F.B.H. EUMERALLA No.1 WELLS

Spore-pollen suites of Lower Cretaceous age have been reported from Pretty Hill No.1 and Eumeralla No.1 wells by Evans (1963, 1966) and Dettmann (1963b). The latter author documents the contained microfloras in terms of her (1963a) microfloral assemblages. An assessment of her records and of additional evidence obtained from further studies of the microfloras enables subdivision of the sequences in terms of the biostratigraphic scheme outlined above..

Pretty Hill No.1 well

?Crybelosporites stylosus Zone: 6690-7214 feet; based upon the presence of Dictyotosporites speciosus at 7200-14 feet and the recovery of a fragmented specimen of Crybelosporites stylosus at 6690-72 feet. The sample at 7585-97 feet did not provide diagnostic floras.

Dictyotosporites speciosus Zone: 5420-6385 feet. Although only impoverished microfloras were obtained from several samples, the following subdivisions of the zone have been recognized:-

Cyclosporites hughesi Subzone 5935-6385 feet.

Foraminisporis asymmetricus "Unit" 5935-47 feet.

Coptospora paradoxa Zone: 3340-4960 feet. The Dictyotosporites filus "Unit" may be represented at 4940-60 feet.

Tricolpites pannosus Zone: 2923-40 feet.

Eumeralla No.1 well

Dictyotosporites speciosus Zone: 7225-10,303 feet, comprising:-

a) Cyclosporites hughesi Subzone at 7225-10,303 feet in which are represented 1) Rouseisporites reticulatus "Unit" 8143-9390 feet  
2) Foraminisporis asymmetricus "Unit" 7225-7712 feet. (The sample at 10,500-08 did not provide species diagnostic of the units).

b) Crybelosporites striatus Subzone between 6054 feet and 6720 feet.

Coptospora paradoxa Zone: 3300-5316 feet. The Dictyotosporites filus "Unit" has not been recognized; the record of Coptospora striata at 3800-12 feet is interpreted to indicate redeposition (recycling) of the specimen.

Tricolpites pannosus Zone: 3511-21 feet.

#### CONCLUSIONS

Lower Cretaceous sequences in Woolathorpe No.1, Garvoc No.1, and Purrumbete No.1 wells have been subdivided and correlated in terms of the palyno-stratigraphic zonal scheme proposed by Dettmann and Playford (1963) and modified herein. The modified zonal scheme is shown to be applicable to two other Lower Cretaceous sections in the Otway Basin.



Further palynological work is required to establish the applicability of the scheme to Lower Cretaceous sequences developed in other areas of the Australian continent.

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WOOLSTHORPE NO.1

GARVOC NO.1

PURRUMBETE NO.1

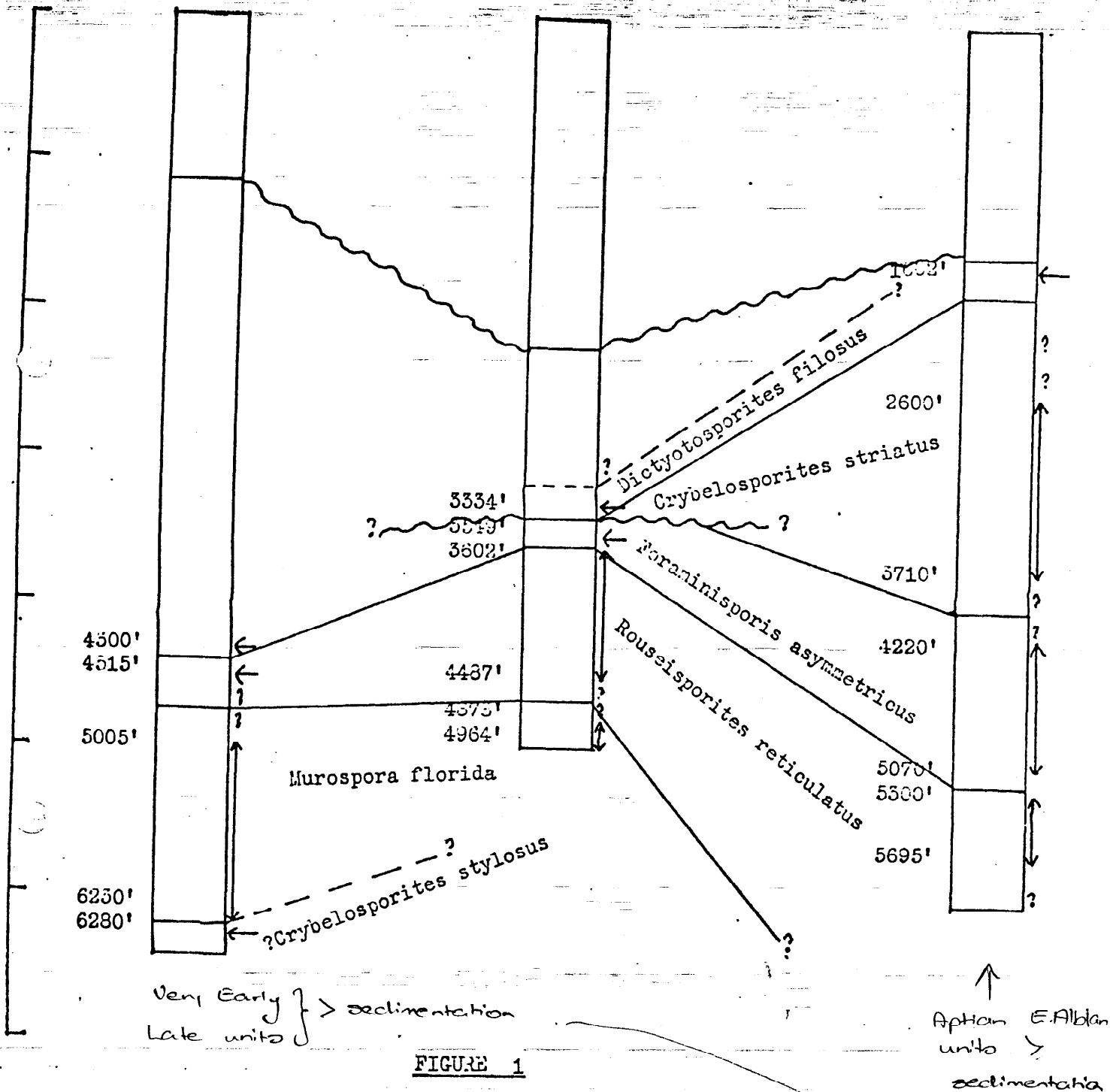


FIGURE 1

Palynological correlation Woolsthorpe No.1, Garvoc No.1, and Purrumbete No.1 wells.

Vertical scale 1" = 1000'; no horizontal scale.

Check when pulses of volcanic