

PALYNOLOGICAL REPORT ON INTERSTATE WOOLSTHORPE NO.1

WELL, 4300 FEET - 6380 FEET

BY

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Twelve samples of sidewall cores taken from between 4300 feet and 6380 feet in Interstate Woolsthorpe No.1 well were submitted for palynological analyses by Shell Development (Australia) Pty. Ltd. All samples yielded plant microfossils in concentrations varying from abundant to sparse. The plant material includes spores, pollen grains, and wood and cuticular fragments. In addition forms possibly of aquatic (Chlorophyceae) origin are of rare occurrence in samples at 4515 feet, 5178 feet, and 6230 feet; microplankton were not encountered in the residues.

The plant material was extracted from the enclosing sediments by use of hydrofluoric acid and zinc bromide (Dettmann 1967), followed in some cases by exposure of the residue for one to two minutes to ultrasonic vibration. The preservation quality of the plant microfossils extracted from the samples is documented in Table 1. From this it is evident that the plant material exhibits little variation in preservation quality throughout the section examined.

Analyses of the spore-pollen floras has provided evidence that the section studied is mostly, if not all, of Lower Cretaceous age. Sediments between 4300 feet and 6230 feet yielded the index of the Dictyotosporites speciosus Zone (Dettmann and Playford 1968) to which a Neocomian - early Albian age is assigned (Evans and Hawkins 1967), and the lowest sample from 6380 feet provided a restricted microflora that is of lowermost Cretaceous or possibly of late Jurassic age.

The microfloral assemblages recovered from the sediments are documented below with reference to their qualitative and quantitative content; the quantitative estimates are expressed in the following terms:- Ab (abundant) - numerical representation of a particular species totals at least 5% of total microflora, C (common) - numerical representation of a species forms 1-5% of total microflora, and R (rare) - numerical representation of a species is less than 1% of total microflora.

MICROFLORAL ASSEMBLAGES AND AGE DETERMINATIONS

A. 4300 feet - 6230 feet

4300 feet

Abundant spores and pollen grains extracted from the sample constitute the following diverse assemblage:

Spores:	<u>Arcellites cf. hexapartitus</u> (Dijkstra)	R
	<u>Aequitriradites spinulosus</u> (Cookson & Dettmann)	C
	<u>Baculatisporites comaumensis</u> (Cookson)	C
	<u>Cicatricosisporites australiensis</u> (Cookson)	Ab
	<u>C. ludbrookii</u> Dettmann	C
	<u>Contignisporites cooksonii</u> (Balme)	C
	<u>C. multimuratus</u> Dettmann	R
	<u>Couperisporites tabulatus</u> Dettmann	R
	<u>Crybelosporites punctatus</u> Dettmann	R
	<u>Cyathidites australis</u> Couper	Ab
	<u>C. minor</u> Couper	Ab
	<u>Dictyotosporites speciosus</u> Cookson & Dettmann	R
	<u>Foraminisporis asymmetricus</u> (Cookson & Dettmann)	R
	<u>F. dailvi</u> (Cookson & Dettmann)	R
	<u>F. wonthaggiensis</u> (Cookson & Dettmann)	R
	<u>Klukisporites scaberis</u> (Cookson & Dettmann)	R
	<u>Lycopodiumsporites austroclavatidites</u> (Cookson)	R

	<u>Pilosporites notensis</u> Cookson & Dettmann	C
	<u>Rouseisporites reticulatus</u> Pocock	R
Pollen:	<u>Araucariacites australis</u> Cookson	R
	<u>Classopollis</u> cf. <u>classoides</u> Pflug	C
	<u>Microcachrydites antarcticus</u> Cookson	Ab
	<u>Podocarpidites</u> cf. <u>ellipticus</u> Cookson	

4515 feet

Spores and pollen grains occur abundantly in the sample and form the following diverse assemblage:

Spores:	<u>Aequitriradites spinulosus</u> (Cookson & Dettmann)	C
	<u>A. verrucosus</u> (Cookson & Dettmann)	R
	<u>Baculatisporites comaumensis</u> (Cookson)	Ab
	<u>Ceratopores equalis</u> Cookson & Dettmann	R
	<u>Cicatricosporites ludbrooki</u> Dettmann	R
	<u>Cooksonites variabilis</u> Pocock	R
	<u>Cyathidites australis</u> Couper	Ab
	<u>C. minor</u> Couper	Ab
	<u>Cyclosporites hughesi</u> (Cookson & Dettmann)	R
	<u>Dictyotosporites speciosus</u> Cookson & Dettmann	R
	<u>Foraminisporis dailyi</u> (Cookson & Dettmann)	R
	<u>Januasporites spinulosus</u> Dettmann	R
	<u>Kraeuselisporites linearis</u> (Cookson & Dettmann)	R
	<u>Leptolepidites verrucatus</u> Couper	R
	<u>Lycopodiumsporites austroclavatidites</u> (Cookson)	R
	<u>L. circolumenus</u> Cookson & Dettmann	R
	<u>Pilosporites notensis</u> Cookson & Dettmann	C
	<u>Trilobosporites purverulentus</u> (Verbitskaya)	R
	<u>Rouseisporites reticulatus</u> Pocock	R
Pollen:	<u>Alisporites grandis</u> (Cookson)	C
	<u>Araucariacites australis</u> Cookson	R
	<u>Classopollis</u> cf. <u>classoides</u> Pflug	C
	<u>Microcachrydites antarcticus</u> Cookson	Ab
	<u>Podocarpidites</u> cf. <u>ellipticus</u> Cookson	C
	<u>Podosporites microsaccatus</u> (Couper)	R
Incertae Sedis:	Gen. et sp. indet. Forma A Eisenack & Cookson 1960	R

4750 feet

The residue contains abundant wood fragments and rare spores and pollen grains. Species identified include:

Spores:	<u>Cyathidites australis</u> Couper
	<u>C. minor</u> Couper
	<u>Cooksonites variabilis</u> Pocock
	<u>Lycopodiumsporites austroclavatidites</u> (Cookson)
	<u>Stereisporites antiquasporites</u> (Wilson & Webster)
Pollen:	<u>Araucariacites australis</u> Cookson
	<u>Podocarpidites</u> cf. <u>ellipticus</u> Cookson

4841 feet

Plant material extracted from the sample includes the following rarely occurring spores and pollen grains:

Spores:	<u>Baculatisporites comaumensis</u> (Cookson)
	<u>Cyathidites australis</u> Couper
	<u>Dictyotosporites speciosus</u> Cookson & Dettmann
	<u>Glukisporites scaberis</u> (Cookson & Dettmann)
	<u>Lycopodiumsporites austroclavatidites</u> (Cookson)
	<u>Neoraistrickia truncata</u> (Cookson)
Pollen:	<u>Araucariacites australis</u> Cookson
	<u>Alisporites similis</u> (Balme)
	<u>Microcachrydites antarcticus</u> Cookson

5005 feet

Spores and pollen grains occur abundantly in the residue which also contains much wood and cuticular matter. The following species were observed:

Spores:	<u>Aequitriradites spinulosus</u> (Cookson & Dettmann)	R
	<u>Baculatisporites comaumensis</u> (Cookson)	C
	<u>Ceratosporites equalis</u> Cookson & Dettmann	R
	<u>Couperisporites tabulatus</u> Dettmann	R
	<del>Cooksonites variabilis</del> Cook	R
	<u>Contignisporites cooksonii</u> (Balme)	R
	<u>Cyathidites australis</u> Couper	C
	<u>C. minor</u> Couper	Ab
	<del>Dictyotosporites speciosus</del> Cookson & Dettmann	R
	<u>Klukisporites scaberis</u> (Cookson & Dettmann)	R
	<u>Leptolepidites verrucatus</u> Couper	C
	<u>L. major</u> Couper	R
	<u>Lycopodiumsporites austroclavatidites</u> (Cookson)	C
	<u>L. eminulus</u> Dettmann	R
	<u>L. nodosus</u> Dettmann	R
	<u>Microspora florida</u> (Balme)	R
	<u>Neoraistrickia truncata</u> (Cookson)	R
	<u>Matonisporites cooksoni</u> Dettmann	R
	<u>Sestrosporites pseudoalveolatus</u> (Couper)	R
	<u>Stereisporites antiquasporites</u> (Wilson & Webster)	Ab
Pollen:	<u>Alisporites grandis</u> (Cookson)	C
	<u>A. similis</u> (Balme)	R
	<u>Araucariacites australis</u> Cookson	C
	<u>Classopollis</u> cf. <u>classoides</u> Pflug	C
	<u>Podocarpidites</u> cf. <u>ellipticus</u> Cookson	Ab
	<u>Microcachrydites antarcticus</u> Cookson	Ab

5178 feet

Abundant spores and pollen grains were extracted from the sample which also includes much wood and cuticular material. The following species were identified:

Spores:	<u>Baculatisporites comaumensis</u> (Cookson)	Ab
	<u>Coronatispora telata</u> (Balme)	R
	<u>Couperisporites tabulatus</u> Dettmann	R
	<u>Cyathidites australis</u> Couper	Ab
	<u>C. minor</u> Couper	Ab
	<u>Dictyotosporites complex</u> Cookson & Dettmann	R
	<del>D. speciosus</del> Cookson & Dettmann	R
	<del>Cyathosporites mughesi</del> Cookson & Dettmann	R
	<u>Foraminisporis dailyi</u> (Cookson & Dettmann)	R
	<u>Leptolepidites verrucatus</u> Couper	C
	<u>L. major</u> Couper	R
	<u>Lycopodiumsporites austroclavatidites</u> (Cookson)	Ab
	<u>L. circolumenus</u> Cookson & Dettmann	R
	<u>L. nodosus</u> Dettmann	R
	<u>Microspora florida</u> (Balme)	R
	<u>Neoraistrickia truncata</u> (Cookson)	C
	<u>Osmundacidites wellmanii</u> Couper	R
	<u>Stereisporites antiquasporites</u> (Wilson & Webster)	C
Pollen:	<u>Alisporites grandis</u> (Cookson)	C
	<u>Araucariacites australis</u> Cookson	C
	<u>Classopollis</u> cf. <u>classoides</u> Pflug	C
	<u>Microcachrydites antarcticus</u> Cookson	Ab
	<u>Podocarpidites</u> cf. <u>ellipticus</u> Cookson	Ab
Incertae Sedis:	<u>Schizosporis reticulatus</u> Cookson & Dettmann	R

5275 feet

Good concentrations of the following species of spores and pollen grains occur in the residue:

Spores:	<u>Baculatisporites comaumensis</u> (Cookson)	C
	<u>Ceratosporites equalis</u> Cookson & Dettmann	R
	<u>Couperisporites tabulatus</u> Dettmann	R
	<u>Cyathidites australis</u> Couper	C
	<u>C. minor</u> Couper	Ab
	<u>Dictyotophyllidites crenatus</u> Dettmann	C
	<u>Dictyotosporites complex</u> Cookson & Dettmann	R
	<u>D. speciosus</u> Cookson & Dettmann	R
	<u>Foraminisporis dailyi</u> (Cookson & Dettmann)	R
	<u>Ischyosporites punctatus</u> Cookson & Dettmann	R
	<u>Leptolepidites verrucatus</u> Couper	R
	<u>L. major</u> Couper	R
	<u>Lycopodiumsporites austroclavatidites</u> (Cookson)	C
	<u>Klukisporites scaberis</u> (Cookson & Dettmann)	R
	<u>Neoraistrickia truncata</u> (Cookson)	C
	<u>Stereisporites antiquasporites</u> (Wilson & Webster)	C
Pollen:	<u>Alisporites similis</u> (Balme)	R
	<u>Araucariacites australis</u> Cookson	C
	<u>Classopollis</u> cf. <u>classoides</u> Pflug	C
	<u>Microcachrydites antarcticus</u> Cookson	Ab
	<u>Podocarpidites</u> cf. <u>ellipticus</u> Cookson	Ab

5495 feet

Fairly preserved spores and pollen grains occur commonly in the residue and include the following forms:

Spores:	<u>Aequitriaradites spinulosus</u> (Cookson & Dettmann)	R
	<u>Baculatisporites comaumensis</u> (Cookson)	Ab
	<u>Ceratosporites equalis</u> Cookson & Dettmann	C
	<u>Cicatricosisporites australiensis</u> (Cookson)	R
	<u>Couperisporites tabulatus</u> Dettmann	R
	<u>Cyathidites australis</u> Couper	C
	<u>C. minor</u> Couper	Ab
	<u>Dictyotosporites speciosus</u> Cookson & Dettmann	R
	<u>Leptolepidites verrucatus</u> Couper	C
	<u>Lycopodiumsporites austroclavatidites</u> (Cookson)	R
	<u>L. circolumenus</u> Cookson & Dettmann	R
	<u>Neoraistrickia truncata</u> (Cookson)	C
	<u>Pilosporites notensis</u> Cookson & Dettmann	R
Pollen:	<u>Alisporites grandis</u> (Cookson)	C
	<u>A. similis</u> (Balme)	R
	<u>Araucariacites australis</u> Cookson	C
	<u>Classopollis</u> cf. <u>classoides</u> Pflug	C
	<u>Cycadopites nitidus</u> (Balme)	C
	<u>Microcachrydites antarcticus</u> Cookson	Ab
	<u>Podocarpidites</u> cf. <u>ellipticus</u> Cookson	Ab

5900 feet

Spores and pollen grains are of rare occurrence in the residue which contains little other plant material. Species observed include:

Spores:	<u>Klukisporites scaberis</u> (Cookson & Dettmann)
Pollen:	<u>Araucariacites australis</u> Cookson
	<u>Classopollis</u> cf. <u>classoides</u> Pflug
	<u>Podocarpidites</u> cf. <u>ellipticus</u> Cookson

6090 feet

A small residue containing spores and pollen grains and some wood and cuticular material was extracted from the sample. Spore-pollen species observed include:

Spores:	<u>Baculatisporites comaumensis</u> (Cookson)	Ab
	<u>Ceratosporites equalis</u> Cookson & Dettmann	R
	<u>Cyathidites australis</u> Couper	C
	<u>C. minor</u> Couper	Ab
	<u>Lycopodiumsporites austroclavatidites</u> (Cookson)	C
Pollen:	<u>L. eminulus</u> Dettmann	R
	<u>Alisporites grandis</u> (Cookson)	C
	<u>Araucariacites australis</u> Cookson	C
	<u>Microcachrydites antarcticus</u> Cookson	Ab
	<u>Podocarpidites cf. ellipticus</u> Cookson	Ab

6230 feet

The sample yielded abundant spores and pollen grains intermixed with wood and cuticular material. Species identified include:

Spores:	<u>Baculatisporites comaumensis</u> (Cookson)	Ab	
	<u>Ceratosporites equalis</u> Cookson & Dettmann	C	
	<del><u>Cicatricosisporites ludbrookii</u> Dettmann</del>	R	
	<u>Contignisporites cooksonii</u> (Balme)	R	
	<u>Coronatispora telata</u> (Balme)	R	
	<del><u>Cyclosporites hughesi</u></del> (Cookson & Dettmann)	R	
	<u>Cyathidites australis</u> Couper	Ab	
	<u>C. minor</u> Couper	Ab	
	<u>Dictyotosporites complex</u> Cookson & Dettmann	R	
	<u>D. speciosus</u> Cookson & Dettmann	R	
	<u>Foveotriletes parviretus</u> (Balme)	C	
	<u>Foraminisporis dailyi</u> (Cookson & Dettmann)	R	
	<u>Januasporites spinulosus</u> Dettmann	R	
	<u>Klukisporites scaberis</u> (Cookson & Dettmann)	R	
	<u>Leptolepidites verrucatus</u> Couper	C	
	<u>L. major</u> Couper	R	
	<u>Lycopodiumsporites austroclavatidites</u> (Cookson)	C	
	<u>L. circolumenus</u> Cookson & Dettmann	C	
	<u>L. eminulus</u> Dettmann	R	
	<u>L. facetus</u> Dettmann	R	
	<u>L. nodosus</u> Dettmann	R	
	<del><u>Murospora florida</u></del> (Balme)	R	
	<u>Lycopodiacidites asperatus</u> Dettmann	R	
	<u>Neoraistrickia truncata</u> (Cookson)	C	
	<u>Sestrosporites pseudoalveolatus</u> (Couper)	R	
	<u>Velosporites triquetrus</u> (Lantz)	R	
	Pollen:	<u>Alisporites similis</u> (Balme)	C
		<u>Araucariacites australis</u> Cookson	C
		<u>Classopollis cf. classoides</u> Pflug	C
		<u>Microcachrydites antarcticus</u> Cookson	Ab
		<u>Podocarpidites cf. ellipticus</u> Cookson	Ab
		<u>Tsugaepollenites dampieri</u> (Balme)	R
Incertae Sedis:	<u>Schizosporis reticulatus</u> Cookson & Dettmann	R	

Sediments between 4300 feet and 6230 feet yielded microfloras that contain Dictyotosporites speciosus. The horizons are accordingly referred to the Dictyotosporites speciosus Zone to which Dettmann and Playford (1968) assigned a Neocomian - Upper Aptian age on the basis of the zones occurrence in Oodnadatta No.1 well, South Australia. Evans and Hawkins (1967) question Ludbrook's (1966) designation of the Aptian/Albian boundary in the Oodnadatta well and indicate that in Queensland upper horizons of the zone are of Lower Albian age.

In Woolthorpe No.1 well, horizons between 4515 feet and 6230 feet are referred to the Cyclosporites hughesi Subzone of the D. speciosus Zone on the basis of the association of D. speciosus and C. hughesi.

According to Evans and Hawkins (1967), the C. hughesi Subzone is of Neocomian - Aptian age. The uppermost sample investigated at 4300 feet failed to yield diagnostic criteria of either the C. hughesi or Crybelosporites striatus Subzones.

Microfloras recovered from the D. speciosus Zone in Woolsthorpe No.1 well are composed of spores and pollen grains and lack microplankton. Types assigned by some authors to the Acritarcha but believed by others to have derived from the Chlorophyceae occur rarely at 4515 feet, 5178 feet, and 6230 feet. These types are Schizosporis reticulatus (for affinity see Brenner 1963) and gen et sp. indet. Form A of Eisenack and Cookson 1960 (see Evans 1966).

#### B. 6380 feet

Spores and pollen grains are of common occurrence in the residue and include the following species:

Spores:	<u>Baculatisporites comaumensis</u> (Cookson)	Ab
	<u>Ceratospores equalis</u> Cookson & Dettmann	C
	<u>Coronatispora telata</u> (Balme)	R
	<del><u>Crybelosporites stylosus</u> Dettmann</del>	R
	<u>Cyathidites australis</u> Couper	Ab
	<u>C. minor</u> Couper	Ab
	<u>Leptolepidites verrucatus</u> Couper	R
	<u>L. major</u> Couper	R
	<u>Lycopodiumsporites circolumenus</u> Cookson & Dettmann	C
	<u>L. austroclavatidites</u> (Cookson)	R
	<u>Neoraistrickia truncata</u> (Cookson)	R
	<u>Osmundacidites wellmanii</u> Couper	C
	<u>Stereisporites antiquasporites</u> (Wilson & Webster)	R
Pollen:	<u>Alisporites grandis</u> (Cookson)	R
	<u>A. similis</u> (Balme)	C
	<u>Araucariacites australis</u> Cookson	C
	<u>Classopollis</u> cf. <u>classoides</u> Pflug	C
	<u>Cycadopites nitidus</u> (Balme)	R
	<del><u>Microcachrydites antarcticus</u> Cookson</del>	Ab
	<u>Podocarpidites</u> cf. <u>ellipticus</u> Cookson	R
	<u>Perinopollenites</u> sp.	C
	<u>Tsugaepollenites dampieri</u> (Balme)	R

The microflora contains an abundance of cyatheaceous and osmundaceous spores and of the gymnospermous Microcachrydites antarcticus. These features are characteristic of Australian late Jurassic and early Cretaceous microfloras. A late Jurassic - early Cretaceous age is supported by the presence of Coronatispora telata and Lycopodiumsporites circolumenus. A single doubtful specimen of Crybelosporites stylosus was observed, but other forms diagnostic of the Crybelosporites stylosus Zone (of late Jurassic - Valanginian age) were not encountered.

#### CONCLUSIONS

Horizons between 4300 feet and 6230 feet in Woolsthorpe No.1 well are referable to the Neocomian - Lower Albian Dictyosporites speciosus Zone; the Cyclosporites hughesi Subzone (Neocomian - Aptian) of this zone was recognized in samples from between 4515 feet and 6230 feet, and the sample at 4300 feet provided insufficient data for subzonal assignment. The lowest sample (6380 feet) investigated contains a late Jurassic or early Cretaceous microflora, but zonal attribution is precluded by the absence of diagnostic species.

The fair to poorly preserved microfloras extracted from the Woolsthorpe well are composed chiefly of spores and pollen grains and occasional forms that may have derived from the Chlorophyceae were also observed.

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## EXPLANATION OF TABLE 1

Preservation and zonal attribution of plant microfossil assemblages in Interstate Woolsthorpe No.1 well, 4300 feet - 6380 feet.

## Abbreviations:

Yield expresses frequency of spores and pollen in the palynological residues as follows:-

- Ab = abundant
- C = common
- Sp = sparse

Colour and preservation. Spores, pollen, wood, and cuticle present in the residues are denoted by their colour (col.) and quality of preservation (pres.) thus:-

- DY = dark yellow
- Br = brown
- Bl = black
- fair = fair
- poor = poor

Spore-pollen zones are those defined by Dettmann and Playford (1968).

TABLE 1

Depth (feet)	Yield	Spore-Pollen		Wood		Cuticle		Spore-Pollen Zone
		Col.	Pres.	Col.	Pres.	Col.	Pres.	
4300	Ab	DY-Br	fair	Br-Bl	fair- poor	DY-Br	fair	?
4515	"	"	"	"	"	"	"	Dictyosporites speciosus Zone — 4840 Top P.H. Cyclosporites hughesi P.H. III Subzone — 5905 Top Basal Unit B.V.
4750	Sp	"	"	"	"	"	fair- poor	
4841	"	"	"	"	"	"	"	
5005	Ab	"	"	"	"	"	"	
5178	"	"	"	"	"	"	"	
5275	C	"	"	"	"	"	"	
5495	"	"	"	"	"	"	"	
5900	Sp	"	"	"	"	-	-	
6090	"	"	fair- poor	"	"	DY	fair- poor	
6230	Ab	"	"	"	"	"	"	
6380	C	DY	"	"	"	"	"	?Crybelosporites stylosus Zone