PALYNOLOGICAL REPORT ON WOODSIDE SALT LAKE No.1 WELL, 3914 - 5323 FEET

The present account documents microfloral evidence obtained from fifteen sidewall cores from Woodside Salt Lake No.1 well, between 3914 and 5323 feet. This section is documented (refer Attachment 2; letter 27th July, 1970 E2/88/11) as including the lower portion of the Latrobe Valley Coal Measures (3914 - 4710 feet), basalt (4710- 4845 feet), Childers Formation (4845 - 5210 feet), and Strzelecki Group (5210 - T.D.5395 feet). The sidewall cores examined are from the sedimentary units and include sandstones, mudstones, and siltstones. Several of the sandstone samples (particularly those from the Childers Formation) were found to be extremely friable and were noted as having been impregnated with drilling mud. Moreover, the sample from 5216 feet (Strzelecki Group) appeared to consist entirely of drilling mud contamination.

The samples were cleaned as thoroughly as possible before preparation by the procedure outlined by Dettmann (1970a), and the resultant residues mounted in glycerine jelly on glass microscope slides for microscopic analyses of the contained plant microfossils. All samples were found to contain, in varying quantities, plant microfossils including spores, pollen grains, and fragments of wood and cuticle. Samples from the Latrobe Valley Coal Measures and the Childers Formation also yielded rare dinoflagellate cysts. Qualitative estimates of the individual microfloral assemblages extracted from the samples are documented below. It should be noted that several of the samples yielded readily recognizable contaminants from younger horizons and reworked types from older strata. The possibility that other samples contain high proportions of contaminants and/or recycled forms is discussed in a subsequent section of the report.

MICROFLORAL ASSEMBLAGES

A. Latrobe Valley Coal Measures

3914 feet

Well preserved plant microfossils including spores, pollen grains, and rare dinoflagellate cysts occur in the sample. Species identified include:

Spores	Gleicheniidites circinidites (Cookson)
	Laevigatosporites ovatus Wilson & Webster
	Trilites kopkuensis Couper
Pollen	Casuarinidites cainozoicus Cookson & Pike
	Dacrydiumites balmei Cookson
	D. ellipticus Harris
	D. florinii (Cookson & Pike)
	Duplopollis orthoteichus (Cookson & Pike)
	Malvacipollis diversus Harris
	Nothofagidites emarcidus (Cookson)
	N. cinctus (Cookson)
	N. goniatus (Cookson)
	N. heterus (Cookson)
	Phyllocladidites mawsonii Cookson
	P. reticulosaccatus Harris
	Podocarpidites ellipticus Cookson
	Proteacidites subscabratus Couper
	Triorites harrisii Couper
	Tricolporites prolata Cookson
Microplankton	Kenylea fimbriata Cookson & Eisenack
	Ginginodinium tabulatum Cookson & Eisenack
Remanié	Cicatricosisporites australiensis (Cookson) - Cretaceous

4244 feet

The sample provided abundant and well preserved spores and pollen grains. The following forms were observed:

Spores	Cyathidites australis Couper
	C. splendens Harris
	Gleicheniidites circinidites (Cookson)
	Lycopodiumsporites sp.
	Stereisporites antiquasporites (Wilson & Webster)
	Trilites tuberculiformis Cookson
Pollen	Dacrydiumites balmei Cookson
	D. ellipticus Harris
	D. florinii (Cookson & Pike)
	Dilwynites granulatus Harris
	Microcachryidites antarcticus Cookson
	Nothofagidites emarcidus (Cookson)
	N. brachyspinulosus (Cookson)

Phyllocladidites mawsonii Cookson
P. reticulosaccatus Harris
Polycolpites sp.
Polyporina fragilis Harris
Proteacidites crassus Cookson
P. subscabratus Couper
Tricolporites prolata Cookson
Triorites harrisii Couper
T. edwardsi Cookson & Pike
Tricolpites gillii Cookson

4680 feet

Well preserved spores and pollen grains extracted from the sample comprise the following diverse microfloral suite:

Spores
Gamarozonosporites amplus (Stanley)
C. sp.
Ceratosporites equalis Cookson & Dettmann
Cyathidites australis Couper
C. splendens Harris
Lycopodiumsporites sp.
Stereisporites antiquasporites (Wilson & Webster)
S. sp.
Verrucatosporites speciosus Harris

Pollen
Araucariacites australis Cookson
Dacrydiumites balmei Cookson
D. ellipticus Harris
D. florinii (Cookson & Pike)
Nothofagidites emarcidus (Cookson)
Phyllocladidites mawsonii Cookson
P. reticulosaccatus Harris
Podocarpidites ellipticus Cookson
Proteacidites crassus Cookson
P. reticuloscabratus Harris
P. subscabratus Couper
Tricolpites gillii Cookson
Triorites edwardsi Cookson & Pike
T. harrisii Couper

B. Childers Formation

4876 feet

A sparse assemblage of well preserved spores and pollen grains was extracted from the sample. Types identified include the following forms, some or all of which may be contaminants (see discussion in following section):

Spores	Baculatisporites comaumensis (Cookson)
	Neoraistrickia sp.
	Stereisporites antiquasporites (Wilson & Webster)
Pollen	Dacrydiumites balmei Cookson
	D. ellipticus Harris
	D. florinii (Cookson & Pike)
	Nothofagidites emarcidus (Cookson)
	N. cinctus (Cookson)
	Phyllocladidites mawsonii Cookson
	Podocarpidites ellipticus Cookson
	Proteacidites subscabratus
	P. spp.
	Triorites harrisii Couper
Microplankton	Ginginodinium spinulosum Cookson & Eisenack

4900 feet

The well preserved microflora is sparse and probably includes contaminants (see below). The following types were observed:

Spores	Cyathidites australis Couper
	Gleicheniidites circinidites (Cookson)
	Laevigatosporites ovatus Wilson & Webster
	Verrucatosporites speciosus Harris
	Stereisporites antiquasporites (Wilson & Webster)
Pollen	Dacrydiumites ellipticus Harris
	Microcachryidites antarcticus Cookson
	Nothofagidites emarcidus (Cookson)
	N. goniatus (Cookson)
	Phyllocladidites mawsonii Cookson
	Podocarpidites ellipticus Cookson
	Proteacidites crassus Cookson
	Triorites harrisii Couper

5000 feet

The residue contains fairly plentiful plant microfossils that comprise the following restricted assemblage:

Spores	Gleicheniidites circinidites (Cookson)
	Stereisporites antiquasporites (Wilson & Webster)
Pollen	Dacrydiumites ellipticus Harris
	Nothofagidites emarcidus (Cookson)
	Phyllocladidites mawsonii Cookson
	Podocarpidites ellipticus Cookson
	Proteacidites crassus Cookson
	P. subscabratus Couper
	Triorites edwardsii Cookson & Pike
	T. harrisii Couper
Microplankton	Ginginodinium spinulosum Cookson & Eisenack

5055 feet

The well preserved spore-pollen suite is sparse and contains a significant proportion of contaminants (see below). The following types were observed:

Spores	Clavifera triplex (Bolkhovitina)
	Gleicheniidites circinidites (Cookson)
	Stereisporites antiquasporites (Wilson & Webster)
Pollen	Dacrydiumites ellipticus Harris
	Duplopollis orthoteichus (Cookson & Pike)
	Nothofagidites cinctus (Cookson)
	Phyllocladidites mawsonii Cookson
	Podocarpidites ellipticus Cookson
	Proteacidites annularis Cookson
	P. subscabratus Couper
	Triorites harrisii Couper
	T. edwardsii Cookson & Pike
	T. magnificus Cookson

5104 feet

The sample provided a sparse assemblage in which one to several examples of the following types were observed:

Spores	Stereisporites antiquasporites (Wilson & Webster)
Pollen	Nothofagidites emarcidus (Cookson)
	Phyllocladidites mawsonii Cookson
	Podocarpidites ellipticus Cookson
	Proteacidites crassus Cookson
	Triorites harrisii Couper

5165 feet

Spores and pollen grains extracted from the sample are abundant and noticeably less well preserved than those from higher horizons. Several of the types represented are probably contaminants.

Spores	Baculatisporites comaumensis (Cookson)
	Ceratosporites equalis Cookson & Dettmann
	Cyathidites australis Couper
	C. minor Couper
	Dictyophyllidites crenatus Dettmann
	Foraminisporis asymmetricus (Cookson & Dettmann)
	Klukisporites scaberis (Cookson & Dettmann)
	Kraeuselisporites jubatus Dettmann & Playford
	Leptolepidites verrucatus Couper
	L. major Couper

	Lycopodiumsporites austroclavatidites (Cookson)
	L. eminulus Dettmann
	L. nodosus Dettmann
	Stereisporites antiquasporites (Wilson & Webster)
Pollen	Araucariacites australis Cookson
	Alisporites grandis (Cookson)
	Classopollis cf. classoides Pflug
	Microcachryidites antarcticus Cookson
	Phyllocladidites mawsonii Cookson
	Podocarpidites ellipticus Cookson
	Tsugaepollenites dampieri (Balme)

5173 feet

The microflora exhibits similar preservation quality to that from 5165 feet and includes the following species of spores and pollen grains; some of which are derivatives from higher horizons:

Spores	Baculatisporites comaumensis (Cookson)
	Ceratosporites equalis Cookson & Dettmann
	Cyathidites australis Couper
	C. minor Couper
	C. punctatus (Delcourt & Sprumont)
	Cicatricosisporites ludbrooki Dettmann
	Dictyotosporites speciosus Cookson & Dettmann
	Leptolepidites verrucatus Couper
	Lycopodiumsporites nodosus Dettmann
	Klukisporites scaberis (Cookson & Dettmann)
	Matonisporites cooksoni Dettmann
	Pilosisporites notensis Cookson & Dettmann
	Rouseisporites reticulatus Pocock
	Stereisporites antiquasporites (Wilson & Webster)
Pollen	Alisporites grandis (Cookson)
	Cycadopites nitidus (Balme)
	Nothofagidites emarcidus (Cookson)
	Microcachryidites antarcticus Cookson
	Podocarpidites ellipticus Cookson
	Tricolpites sp.
	Triorites sp.
	Tsugaepollenites dampieri (Balme)

5200 feet

A diverse assemblage of spores and pollen together with rare acritarchs occurs in the sample. Preservation quality of the microfossils is generally fair although several species (contaminants) exhibit good preservation.

Spores	Baculatisporites comaumensis (Cookson)
	Ceratosporites equalis Cookson & Dettmann
	Cicatricosisporites australiensis (Cookson)
	Cyathidites australis Couper
	C. minor Couper
	Foraminisporis dailyi (Cookson & Dettmann)
	Gleicheniidites circinidites (Cookson)
	Klukisporites scaberis (Cookson & Dettmann)
	Leptolepidites verrucatus Couper
	Lycopodiumsporites austroclavatidites (Cookson)
	L. facetus Dettmann
	L. nodosus Dettmann
	L. reticulumsporites (Rouse)
	Laevigatosporites sp.
Pollen	Araucariacites australis Cookson
	Alisporites grandis (Cookson)
	Classopollis cf. classoides Pflug
	Microcachryidites antarcticus Cookson
	Phyllocladidites mawsonii Cookson
	Podosporites microsaccatus (Couper)
	Podocarpidites ellipticus Cookson
	Tsugaepollenites dampieri (Balme)
Acritarcha	Micryhstridium sp.
	Schizosporis spriggi Cookson & Dettmann
Remanié	Nuskoisporites sp.

C. Strzelecki Group

5216 feet

The residue obtained from the sample appears to consist entirely of species derived from horizons of the Latrobe Valley Coal Measures. This is not unexpected since the original sample appeared to be composed of drilling mud.

5259 feet

An abundant and fairly preserved spore-pollen suite was obtained from the sample. Species identified include:

Spores	Baculatisporites comaumensis (Cookson)
	Ceratosporites equalis Cookson & Dettmann
	Cicatricosisporites australiensis (Cookson)
	Cyathidites australis Couper
	C. minor Couper
	Dictyophyllidites crenatus Dettmann
	Dictyotosporites speciosus Cookson & Dettmann
	Foraminisporis dailyi (Cookson & Dettmann)
	F. asymmetricus (Cookson & Dettmann)

	Gleicheniidites circinidites (Cookson)
	Klukisporites scaberis (Cookson & Dettmann)
	Laevigatosporites sp.
	Lycopodiumsporites austroclavatidites (Cookson)
	L. facetus Dettmann
	L. nodosus Dettmann
	Leptolepidites verrucatus Couper
	L. major Couper
	Pilosisporites notensis Cookson & Dettmann
	Reticulatisporites pudens Balme
	Rouseisporites reticulatus Pocock
	Trilites cf. tuberculiformis Cookson
	Stereisporites antiquasporites (Wilson & Webster)
Pollen	Alisporites grandis (Cookson)
	Araucariacites australis Cookson
	Classopollis cf. classoides Pflug
	Microcachryidites antarcticus Cookson
	Podocarpidites ellipticus Cookson
	Podosporites microsaccatus (Couper)
Remanié	Aratrisporites sp. - Triassic
	Nuskoisporites sp. - Permian

5306 feet

The sample yielded a small residue composed entirely of wood fragments.

5323 feet

Wood fragments and occasional cuticular material comprise the plant matter obtained from the sample.

AGE OF THE MICROFLORAS

A. Latrobe Valley Coal Measures

The upper sample of the Latrobe Valley Coal Measures from 3914 feet contains a well preserved microflora in which spores and pollen grains predominant and dinoflagellate cysts are rare. The spore-pollen suite is of Lower Tertiary aspect with occasional recycled Cretaceous forms (Cicatricosisporites australiensis). Amongst the Tertiary forms represented Dacrydiumites balmei, Phyllocladidites reticulosaccatus, and Duplopollis orthoteichus collectively suggest reference of the horizon to Harris' (1965) Triorites edwardsi/Duplopollis orthoteichus Concurrent

Range Zone of Middle - Upper Paleocene age. Other forms (e.g. Nothofagidites goniatus) are known only from Eocene microfloras and are interpreted as contaminants from higher in the sequence. A Middle - Upper Paleocene age is supported by the contained dinoflagellate cysts referred to Kenylea fimbriata and Ginginodinium tabulatum (see Cookson and Eisencak 1965; 1967a,b).

Samples from 4244 and 4680 feet contain Dacrydiumites balmei, D. ellipticus, Phyllocladidites reticulosaccatus, and Triorites edwardsii, the association of which signify a Middle Paleocene age (Harris 1965) and reference of the sediments to Harris's Triorites edwardsii Assemblage Zone.

B. Childers Formation

Samples from between 4876 feet and 5104 feet yielded 'mixed' microfloras containing uppermost Cretaceous - Paleocene, and Eocene or later elements. As discussed previously the samples were friable sandstones suspected as having been invaded by drilling mud and it is possible that all forms extracted are derivatives from higher horizons. The Eocene forms (Triorites magnificus, Nothofagidites goniatus etc.) generally exhibit a distinct mode of preservation from those of Paleocene - uppermost Cretaceous age, and a close search did not reveal the presence of pre-uppermost Cretaceous forms.

The age of the microfloras is here adduced from the occurrence of Dacrydiumites balmei, D. ellipticus, Triorites edwardsii, and Ginginodinium tabulatum . Collectively these forms indicate an uppermost Cretaceous - lowermost Tertiary age. The absence of Phyllocladidites reticulosaccatus (present in stratigraphically higher horizons) may suggest an age older than that of horizons between 4244 and 4680 feet in the Latrobe Valley Coal Measures. It should be emphasized that the uppermost Cretaceous - lowermost Tertiary age can only be regarded with caution in view of the

possibility of contamination from stratigraphically higher sediments.

Samples taken from siltstone and mudstone horizons between 5165 and 5200 feet from the basal part of the Childers Formation yielded high concentrations of plant microfossils including abundant spores and pollen grains and rare acritarchs. Stratigraphically significant species identified include Dictyotosporites speciosus (5173 feet), Pilosisporites notensis (5173 feet), Foraminisporis asymmetricus (5165 feet), and Dictyophyllidites crenatus (5165 feet). The presence of these species suggests the horizons are from the middle or upper portions of Dettmann and Playford's Dictyotosporites speciosus Zone (i.e. from the top of the Cyclosporites hughesi Subzone or from the Crybelosporites striatus Subzone) of Lower Cretaceous (Neocomian - Lower Albian)age. The majority of other forms represented are long-ranging within the Upper Mesozoic. However, the residues also include occasional angiospermous grains (Nothofagidites, simple tricolpate and triporate froms), Phyllocladidites, and Kraeuselisporites jubatus, the majority of which are interpreted to represent contaminants from higher horizons in the well. Nevertheless, the presence of K. jubatus is bewildering, since the species is known only from Late Albian - Early Senonian, and thus could hardly be expected to have derived from the latest Cretaceous - Tertiary section in the well. It is possible that the horizons are of mid Cretaceous age and that their contained microfloras are largely reworked from pre-Upper Albian strata. However, the evidence is inconclusive and can only be evaluated in the light of other stratigraphical data.

If the horizons are in fact within the Dictyotosporites speciosus Zone, then the lower portion of the Childers Formation can be regarded as a correlative of the Strzelecki Group.

C. Strzelecki Group

The sample from 5216 feet is considered to represent sediment from stratigraphically higher horizons in the well on account of the preponsity of Eocene and Paleocene types represented in the microflora.

The sample from 5259 feet provided a rich assemblage of fairly preserved spores and pollen grains. Stratigraphically significant species identified include Dictyotosporites speciosus, Pilosisporites notensis, Rouseisporites reticulatus, and Foraminisporis asymmetricus. On this basis the sediment is considered to be from within the middle or upper portion of the Dictyotosporites speciosus Zone (i.e. from the upper part of the Cyclosporites hughesi Subzone or the Crybelosporites striatus Subzone). A close search failed to reveal the presence of the indices of either the C. hughesi or C. striatus Subzones, and hence the age attribution can be no more precise than Neocomian - Lower Albian. The microflora also yielded several examples of reworked types of Permian and Triassic age.

Underlying horizons (5306 and 5323 feet) failed to provide spores and pollen grains, although fine woody material was observed in both samples.

COMPARISON AND CORRELATION OF SALT LAKE No.1 WITH OTHER WELL SEQUENCES IN THE GIPPSLAND BASIN

In order to appreciate the biostratigraphic relationships existing between the Latrobe Valley Coal Measures, the Childers Formation, and the "Golden Beach Beds" in Salt Lake No.1, Colliers Hill No.1, Merriman No.1, and Golden Beach West No.1, core samples from the last two-mentioned wells have been reinvestigated (see also data documented in Dettmann 1966a) and the results incorporated in Table 1.

If the uppermost Cretaceous - lowermost Tertiary dating of the middle and upper portions (4876 - 5104 feet) of the Childers Formation in Salt Lake No.1 is correct, then the basalt, which overlies the Childers Formation and is itself overlain by Paleocene horizons of the Latrobe Valley Coal Measures, can be regarded as uppermost Cretaceous - lowermost Tertiary age. Similarly the middle and upper portions of the Childers Formation in Salt Lake No.1 can be considered correlatives of the basal portions of the Latrobe Valley Coal Measures in Colliers Hill No.1 and Golden Beach West No.1.

From Table 1 it is also evident that the top of the "Golden Beach Beds" is clearly younger in Merriman No.1 (sediments containing Nothofagidites Microflora) than in Colliers Hill No.1 (Tricolpites pachyexinus Zone). In Colliers Hill No.1 an hiatus is suspected to occur within the "Golden Beach Beds" between horizons of the Tricolpites pachyexinus and Appendicisporites distocarinatus Zones. In Merriman No.1 and Golden Beach West No.1 a disconformity also appears to be represented within the "Golden Beach Beds"; the precise time extents of the hiatus is however difficult to adduce because of insufficient coverage of samples. In Merriman No.1 the hiatus appears to include some or all of the interval of time represented by the T. pachyexinus together with the Clavifera triplex and/or Appendicisporites distocarinatus Zones. In Golden Beach West No.1 the disconformity may represent a lesser time interval during which portions of the C. triplex and/or A. distocarinatus Zones were deposited.

The basal horizons od the Childers Formation in Salt Lake No.1 are possibly of Lower Cretaceous age and within the Dictyotosporites speciosus Zone. Such an assignment suggests that the base of the

Childers Formation in Salt Lake No.1 is equivalent to portions of the Strzelecki Group as developed in other sequences in the Gippsland Basin (see Table 2). The top of the Strzelecki Group in Salt Lake No.1 is also within the D. speciosus Zone and is clearly older than upper horizons of the Strzelecki Group examined in Woodside South No.1, Darriman No.1, and Lake Reeve No.1 (see Table 2). This evidence and other data tabulated in Table 2 indicates that the top of the Strzelecki Group does not form a time-concordant surface.

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	Colliers Hill No.1	Golden Beach West No.1	Merriman No.1	Salt Lake No.1
Eocene	1860-2905ft.	5076 ft.	not identified in sampled section	not identified in sampled section
Paleocene	not identified in sampled section	not identified in sampled section	not identified i n sampled section	3914-4680 ft.
uppermost Cretaceous-lowermost Tertiary	4090 ft.	5415 ft.	not identified in sampled section	?4876-5104
Nothofagidites	absent	not identified in sampled section	4705 ft.	absent
T ricolpites Bachyexinus	4159-5250ft.	6380 ft.	? absent	absent
Clavifera triplex	?absent	6848 ft.	5070 ft.	absent
Appendicisporites distodarinatus	5425-5550 ft.			?absent

TABLE 1. Biostratigraphic relationships of sediments in Colliers Hill No.1, Golden Beach West No.1, Merriman No.1, and Salt Lake No.1 wells. Upper Cretaceous spore-pollen zones are those defined by Dettmann and Playford 1969.

Legend: Latrobe Valley Coal Measures

Childers Formation

"Golden Beach Beds"