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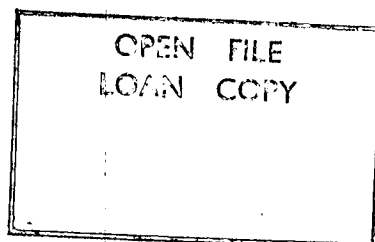
PALYNOLOGICAL REPORT ON SOUTH PACIFIC PTY. LTD.

(BIRKHEAD) WELL

by

P. R. Evans

July 1961



Records No. 1961/102

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SUMMARY

An examination of twenty-two samples, chiefly cuttings, from S.P.L. No.1 (Birkhead) well has suggested that the Permian - Triassic boundary lies at a depth between 3600 and 3700 feet below ground level, that a marine influence in Upper Permian times was present and that possibly a somewhat older unit than Upper Permian was present at 5000 feet. No evidence for the age of strata above 1900 feet and below 5035 feet is offered.

INTRODUCTION

During 1957, South Pacific Pty. Ltd. No.1 (Birkhead) well was drilled to a total depth of 5186 feet; the well was located 21.6 miles north of Tambo, Queensland, at Lat. 24° 36' 34" S. Long. 146° 23' 27" E. The rotary table elevation was 1570 feet where the ground level was 1556 feet above sea level. Five cores were cut at intervals where gas shows occurred during drilling.

The strata cut in the well were subdivided into Systems (fig.1)(*) by the company geologist (Grissett, 1957) on the basis of lithological and electric log characteristics along. He placed the top of the Permian at 1200 feet where arenaceous beds were replaced downwards by argillaceous sediments in association with a pronounced shift in the resistivity curve. He considered that the well was spudded into beds of Jurassic age and originally assumed that no Triassic would be present. As the entire Jurassic of the area measured no more than 1080 feet in thickness, he thought that, unless the Triassic was included in the column, the lower Jurassic would be 1200 feet thick, an improbable value.

Grissett hoped to recognize the Mantuan Productus Bed as a marker; he considered that a sandy limestone at 3030-3035 and 3040-3045 feet was the only possibility, but it carried no shell fragments and he thought it was too low in the sequence.

(*) The lithological column in fig.1 is reduced from the percentage log in the company report and is provided merely to illustrate the general sedimentary sequence.

He distinguished well developed limestones and dolomitic limestones with interbedded shale between 4850 and 5040 feet from the overlying "Permian" and suggested a Carboniferous age for this distinctive facies.

A marked increase in resistivity, combined with the increase in dip from about horizontal in higher cores to 40° in the very indurated sediments of core 5 (5134-5143 feet), led Grissett to distinguish the Devonian below 5040 feet.

No fossils were recorded in the company report, but the Geological Survey of Queensland (1960) mentions the presence of possible Gangamopteris or Glossopteris in the calcareous, unmetamorphosed, but steeply dipping shale of core 5.

Recently the Geological Survey of Queensland provided samples from their collection from the Birkhead well so that a palynological check on the "Permian" section of the column could be made. This paper outlines the observations and conclusions reached on the basis of that material.

STRATIGRAPHIC CONCLUSIONS

The final column in fig. 1 indicates the probable position of Permian - Triassic boundary from a palynological study. Since cuttings provided the bulk of the evidence, this interpretation must be treated with some caution. However, core 4 (3600 feet) provided what may be regarded as basically a Triassic assemblage and the first assemblage acceptable as Permian was extracted from cuttings at 3700 feet. Species common to both the Permian and Triassic were extracted from cuttings at 2900 feet, but recent work in the Roma area of Queensland, where the problem of the Permian - Triassic boundary has come under examination, strongly favours a Triassic age for this sample.

Until the well is more systematically examined, pending the completion of an analysis of better dated Triassic sections, the relative parts of the Triassic represented in the well cannot be stated with certainty. However, the presence of a number of striate pollens at 2900 feet suggests a Lower Triassic (Narabreen) age for that horizon while the presence of Tholosporites parvitholus, Acanthotriletes unicatus and A. ericianus at 3700 feet indicates that Upper Permian (Upper Bowen) sediments had been entered by this second level.

The presence of the microplankton Baltisphaeridium sp. nov. 3 (*) at 3800 feet and below is significant since this species has been found in the subsurface Latemore Formation in the Roma area and in a shaly upper division of the Catherine Sandstone of outcrop. The shale is distinguished by Mines Administration Pty. Ltd. geologists from the overlying Lower Bandanna Formation by an intervening limestone referred to the Mantuan Productus Beds. The species seems to have a restricted range in strata to the south-east of the Serocold anticline, but this point is still being clarified. It is associated with Baltisphaeridium sp. nov. 2 (*) (another Roma species) at 4200-4205 feet in the Birkhead well, but the main difference between the

(*) The species is labelled in accord with its designation in M.S. (Evans, 1961).

faunas of the two areas lies in the apparent absence from Birkhead of the other species which compose a more varied microfaunal assemblage in the Roma sections. It is suggested, therefore, that equivalents of the Mantuan Productus Beds may occur near to 3,800 feet in the Birkhead well.

The age of sediments below 4,600 feet is uncertain since the bulk of samples contained either no microspores or badly corroded ones with a few well preserved Permian or (?)Triassic species. The samples at 5,000 feet and 5,035 feet were different containing extremely carbonized dark brown pteridophyte microspores, showing little resemblance to forms known to occur in definite Permian strata. It is possible, but not proven that a pre-Upper Permian interval was penetrated at 5,000 feet.

No samples were examined from the more steeply dipping beds below 5,040 feet.

The transfer of the Permian-Triassic boundary to as low as 3,600 - 3,700 feet does not agree with the interpretation of the well by either South Pacific Pty. Ltd. or by Webb (in Geological Survey of Queensland, 1960). An interpretation of at least 2,400 feet of Triassic sediments below possible "Bundamba - Marburg" equivalents compares in thickness to sediments to the south-east of the Serocold anticline, where the Rewan, Clematis and Moolayember Formations and a basal portion of the "Bundamba Group" (Shell (Queensland) Development Pty. Ltd., 1952) total about 4,000 feet of strata. Whitehouse (1954, p.6) considered that the Moolayember Shale extended westwards across the Nogoa River, although Tweedale et al. (1960, p.285) point out that proof of lateral continuity between these and the type area is masked by the covering of Tertiary basalts of the Buckland Tableland. Whitehouse estimated that a possible 1,200 feet of Moolayember Shale may outcrop in the Nogoa region. Although any comparison of the Birkhead sequence with this formation on a palynological basis must be speculative until fresh outcrop material has been examined, it appears certain that the Birkhead ~~Lower~~ Triassic includes equivalents in age of the Moolayember Shale, but there is insufficient evidence to state whether or not the underlying sandstones of the Nogoa region (Clematis Sandstone, Whitehouse (1954); cf. Tweedale et al (1960)) were also deposited during the same time unit. Tweedale (1960, p.215) notes that the "Moolayember" and "Clematis" of Whitehouse in this region are equivalents of part of the Cheshire Formation of Woolley (1941), the lower part of which Tweedale considers to be Permian. It is possible, therefore, that equivalents of the Cheshire Formation may be fully represented in the Birkhead well but that equivalents of the underlying Colinlea and Joe Joe Formations of the Permo-Carboniferous of outcrop either are not present or are much reduced or not penetrated by the well.

OBSERVATIONS

The following notes briefly describe the observations on each sample.

Cuttings, 1900 feet (MFP 1113) (*)

No specimens are specifically identifiable with published Australian species, but abundant bisaccate pollens which could be referred to Pityosporites were present. They include types allocated to Pteruchipollenites in unpublished notes on Triassic microfloras by Dr. de Jersey of the G.S.Q. and whose opinion has been followed by the author. Thick exined, granulate, verrucate and rugulate pteridophyte microspores are also present together with a few bisaccate, striate pollens. Until a study in detail of Triassic microspores is available a more precise age than Triassic for this sample cannot be attempted. The presence of striate pollens, however, suggests that a Lower or perhaps Middle Triassic (Narrabeen) age is probable.

Cuttings, 2100 feet (MFP 1114)

As for 1900 feet,

"Pteruchipollenites" spp.) common,
 "Pityosporites" spp.)
Murornati (rugulate).

Triassic.

Cuttings, 2170 feet (MFP 1115)

"Pityosporites" spp.) common,
 "Pteruchipollenites" spp.)
Murornati (rugulate),
Ginkocycadophytes sp.

Triassic.

Core No.2, 2630-2650 feet (MFP 1111)

"Pityosporites" spp.,) common,
 "Pteruchipollenites" spp.,)
Caytonipollenites sp.,
Leiotriletes cf. directus Balme & Hennelly, 1956,
Apiculati (acanthine and verrucate)
Murornati (rugulate),
 aff. Annulispora sp.

Triassic.

Cuttings, 2900 feet (MFP 1116)

"Pityosporites" spp.,)
 "Pteruchipollenites" spp.,) common,
Striatiti sp. several specimens,
 25A de Jersey 1946,
Apiculati sp.,
Murornati sp.,
 aff. Marsupipollenites sinuosus
 Balme & Hennelly, 1956,
 aff. Protosacculina multistriatus
 (B. & H. 1955.).

(*) The numbers in brackets signify the label under which the sample and slides therefrom are registered in the B.M.R. Palaeontological collection.

The last two forms are referred to species initially described from Permian strata, but, in the present case the lack of other species (see below) which are considered to be more diagnostic of the Permian in Australia and the presence in much greater quantities of the Apiculati and Murornati common to higher samples suggest that this one was from Lower Triassic beds.

Core No.4, 3600 feet (MFP 1112)

The porous, calcareous sandstone of core 4 was treated with caution against the possibility of contaminating microspores having been circulated in the drilling fluid, thence to be forced into pores between the sand grains. A small yield was obtained; it differed from those at higher levels by the absence of saccate pollens of the Tityosporites type, by the presence of a large Vestigisporites sp. nov. and of common Laevigati sp. Cirratriradites sp. nov. and an Apiculati (baculate) sp. nov. were also present.

The absence of species which have been regarded as diagnostic of either the Triassic or the Permian leaves the age of the sample open to question. Examination of cuttings between this level and 2900 feet might provide the answer, but as a definite Permian assemblage was extracted from the next sample available below this core (3700 feet), it is suggested for the present that the core at 3600 feet was of Triassic age.

Cuttings 3700 - 3705 feet (MFP 1300)

An abundant and well preserved assemblage included the following species:

Leiotriletes directus, Balme & Hennelly, 1956,
Granulatisporites micronodosus, B. & H., 1956,
G. trisinus, B. & H., 1956,
Verrucosisporites trisecatus, B. & H., 1956,
Acanthotriletes ericianus, B. & H., 1956,
A. unicus, B. & H., 1956,
Tholosporites parvitholus, B. & H., 1956,
Cirratriradites splendens, B. & H., 1956,
Lunatisporites amplus, (B. & H., 1955),
L. limpidus, (B. & H., 1955),
Vesicaspora ovata, (B. & H., 1955),
Ginkocycadophytes vetus, (B. & H., 1956),
Marsupipollenites sinuosus, B. & H., 1956.

They comprise a typical Upper Permian assemblage (Balme & Hennelly, 1956), the critical species being Acanthotriletes ericianus, A. unicus, Tholosporites parvitholus, and Marsupipollenites sinuosus.

Cuttings, 3800 - 3805 feet (MFP 1301)

Leiotriletes directus,
Calamospora diversiformis, B. & H., 1956,
Granulatisporites trisinus,
Tholosporites parvitholus,
Cirratriradites splendens,
Lunatisporites amplus,
Striatopodocarpidites fusus, (B. & H., 1955),
Marsupipollenites sinuosus,
M. triradiatus striatus, B. & H., 1956.
Baltisphaeridium sp. nov. 3.

Apart from the lack of some acanthine species, the significant distinction between this assemblage and the one at 3700 feet is the presence of Baltisphaeridium sp. nov. 3 which suggests that marine or brackish water conditions existed at the time of deposition.

Cuttings, 3900-3905 feet (MFP 1302)

Triassic species only, presumably from cavings.

Cuttings, 4000 - 4005 feet (MFP 1303);
4100 - 4105 feet (MFP 1304)

A few unidentifiable fragments of microspores present.

Cuttings, 4200 - 4205 feet (MFP 1305)

Leiotriletes directus,
Granulatisporites micronodosus,
Tholosporites parvitholus,
Apiculati spp. nov.,
Cirratriradites splendens,
Nuskoisporites gondwanensis, B. & H., 1956,
Bascanisporites undosus, B. & H., 1956.
Lunatisporites amplus,
L. limpidus,
Protosacculina multistriatus, (B. & H., 1955)
Vesicaspora ovata,
Vestigisporites sp.
Ginkocycadophytes vetus.

Baltisphaeridium sp. nov. 2,
B. sp. nov. 3. (fairly common).

Cuttings, 4300 - 4305 feet (MFP 1306)

Leiotriletes directus,
Calamospora diversiformis,
Granulatisporites cf. trisinus,
Acanthotriletes unicatus,
Tholosporites parvitholus,
Apiculati spp. nov.
Lunatisporites limpidus,
aff. Limitisporites,
Protosacculina multistriatus,
Vesicaapora ovata,
Ginkocycadophytes vetus,
Mamripollenites triradiatus striatus,

Baltisphaeridium sp. nov. 3.

A number of probable contaminants from the
Triassic.

Cuttings, 4400 - 4405 feet (MFP 1307)

Leiotriletes directus,
Apiculati spp. nov.,
Bascanisporites undosus,
Lunatisporites amplus,
L. limpidus,
Striatites cancellatus, (B. & H., 1955),
Striatopodocarpidites fusus,
Protosacculina multistriatus,
Marsupipollenites triradiatus striatus,

Baltisphaeridium sp. nov. 3
aff. Tasmanites sp. nov.

The samples at 4200, 4300 and 4400 feet are still Upper Permian in age, and, in common with that at 3800 feet contain microplankton. The stratigraphic significance of these species is discussed on p. 2. Tasmanites was considered originally to be a fossil spore of unusual design, but Eisenack (1958) considered it to be a type of marine micro-organism. Although much smaller than the original Tasmanites, the present species displays the characteristic punctae in a thick and otherwise smooth wall.

Cuttings, 4500 - 4505 feet (MFP 1308)

Barren.

Cuttings, 4600 - 4605 feet (MFP 1309)

A small yield of a variety of species including,

Leiotriletes directus,
Granulatisporites micronodosus,
G. trisinus,
Acanthotriletes ericianus,
A. tereteangulatus, B. & H., 1956,
A. dentatus, B. & H., 1956,
Tholosporites parvitholus,
Apiculati spp. nov.
Cirratriradites splendens,
Lunatisporites limpidus,
Striatopodocarpidites fusus,
Protosacculina multistriatus,
Vesicaspora ovata.

Baltisphaeridium sp. nov. 3 (relatively common)

Cuttings, 4700 - 4705 feet (MFP 1310)

A few badly corroded specimens.

Cuttings, 4800 - 4805 feet (MFP 1311);
4845 - 4850 feet (MFP 1312)

Barren.

Cuttings, 4900 - 4905 feet (MFP 1313)

A very small yeild which included the Permian species Acanthotriletes ericianus and Marsupipollenites triradiatus striatus.

Cuttings, 5000 - 5005 feet (MFP 1314)

The Permian species Cirratriadites splendens was recognized, but otherwise only a few pteridophyte microspores, so heavily carbonized to be virtually opaque, were seen. Some were sufficiently translucent to red light for a certain amount of their ornament to be visible, but none could be likened to known Permian species. These and other, but rarer specimens of indeterminate species which were a dark, slightly translucent brown could not be bleached without being destroyed and they did not take stain. It is possible, from their state of preservation which is so different from that of the overlying Upper Permian types, and from their morphology which also differs from the higher forms, that a significantly older section than the Upper Permian is present. Until the specific identity of the carbonized forms is recognized, the age of this sample must remain undetermined.

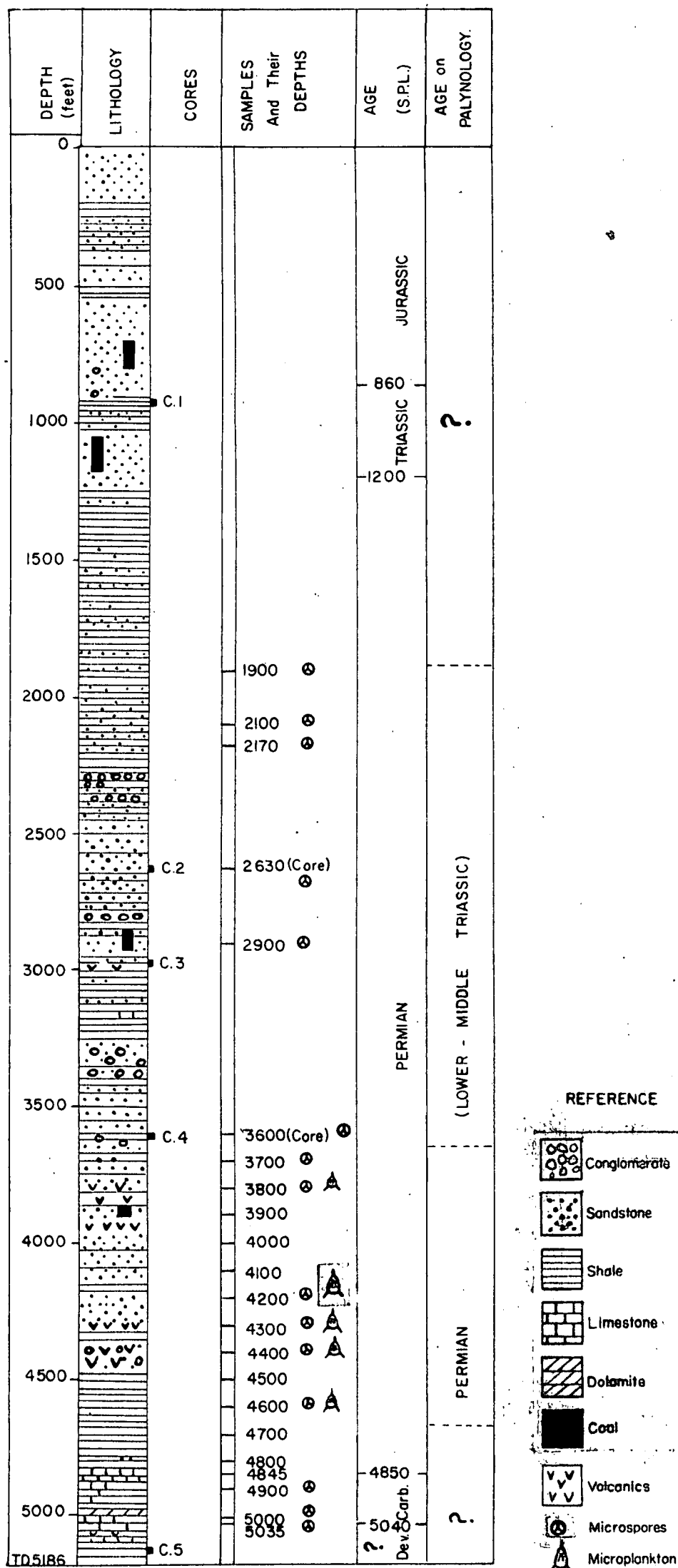
Cuttings, 5035 - 5045 feet (MFP 1315)

Several well preserved rugulate Murornati, similar to the Triassic species higher in the well, are present, but a few carbonized forms comparable to those at 5000 feet also occur.

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S.P.L. No.1 (BIRKHEAD)

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Fig.1. Diagrammatic Section of S.P.L. No.1 (Birkhead) well illustrating revised age determinations of the well section, based on the palynology of selected samples.