COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Record No. 1968 / 130

Petrological Study of Loder (A.O.G.) No.1 Well Sydney Basin, New South Wales

by

Evelyn Nicholas

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by

E. NICHOLAS

PETROLOGICAL STUDY OF LODER (A.O.G.) NO. 1 WELL

SYDNEY BASIN NEW SOUTH WALES

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LODER (AOG) No1

Summary of Petrological Results

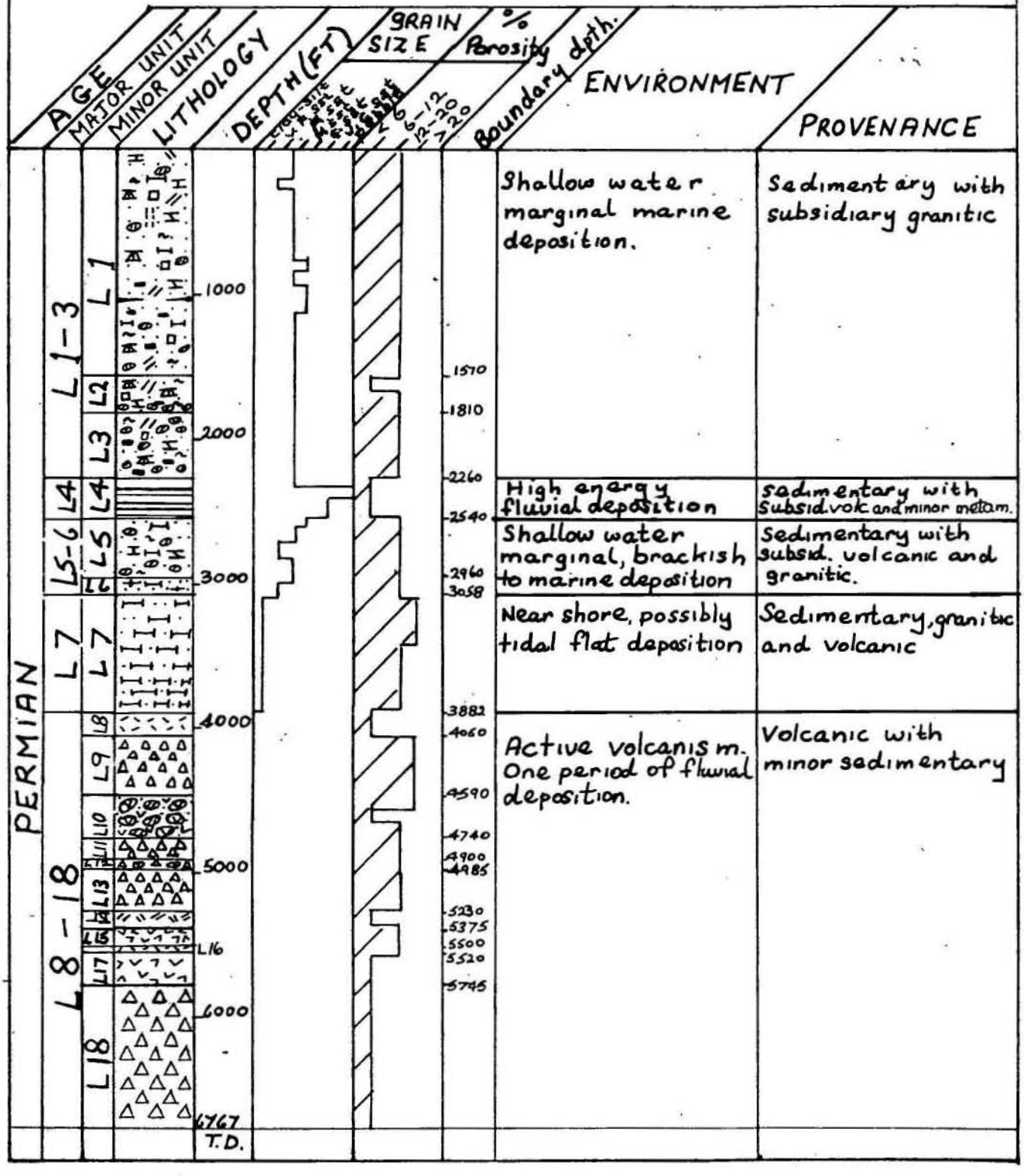


Fig 2.

COMPARISON OF BMR UNITS WITH COMPANY INTERPRETATION

BMR UNITS		BOUNDARY DEPTHS. (FT)	COMPANY (AOG., 1963)		
MAJOR	MINOR		FORMATION	GROUP	AGE
L1-3	L1	22	BRANXTON SUB-GROUP	MAITLAND	PERMIAN
	L2	1570 1000			
	L3	1810 2000			
L4	L4	2260 2258		GRETA C.M.	
L5-6	L5	2540 2580	FARLEY	DALWOOD	
	L6	2960 3000			
L 7	L7	3058 3058	RUTHERFORD		
L8-18	L8	3882 3882	ALLANDALE		
	L9	4060			
	L10	4590			
	L11	4740			
	L12	4900 5000			
	L13	4900			
	L14	4985			
	L15	5230			
	L16	5375 6000			
	L17	5500			
	L18	5745			
		T.D. 6767 7000			

ABSTRACT

This petrological study of Loder (A.O.G.) No. 1 was undertaken as part of a review of the Sydney Basin, currently being carried out by the Basin Study Group of the Petroleum Exploration Branch. The principal objective was to establish and define clearly recognisable rock units, and to reassess the petroleum possibilities of the section.

Eighteen lithologic units were recognised in Loder (A.O.G.) No. 1, and are summarised in Fig. 1. The section starts at the surface in Permian marine sediments of the Branxton Sub-Group, penetrates the Greta Coal Measures, and the marine sediments of the Farley and Rutherford Formations of the Dalwood Group to 3,882'; from there to 6767' (T.D.) the section consists of intermediate to basic volcanics. The eighteen units could be grouped into five major lithogenetic units.

Most of the sedimentary sequence was too tight to act as reservoir rocks, though eleswhere Unit L 1 may have some value as a reservoir rock, and Unit L 7 as a source rock. These units are equated with part of the Branxton Sub-Group and the Rutherford Formation respectively.

GENERAL INFORMATION

Well Data

Well Name, No.	:	Loder (A.O.G.) No. 1 Well
Operating Co.	:	Australian Oil and Gas Corporation Ltd. N.S.W.
Location:		Latitude 32° 38' 07" South
		Longitude 151° 08' 00" East
		1:250,000 Sheet : Singleton SI/56/1
		General Location: about 6 miles S.W. of Singleton, N.S.W.
Elevation:		Kelly Bushing: 355.15'
		Ground Level: 338.40'
Total Depth:		Schlumberger: 6769'
		Driller: 6767'
Logs Run:		Electric Logs: Run 1 - 100' - 537'
		Run 2 - 433' - 545'
		Run 3 - 545' - 2667'
		Run 4 - 2667' 6768'
		Microcaliper: Run 1 - 433' -2665'
		Caliper: Run 1 - 2527' - 6768'
		Sonic: Run 1 - 433' - 2664'
		Run 2 - 2664' - 6765'
Formation Testing:		D.S.T. No. 1: 3238' - 3383', Recovered 240' of drilling mud with no indications of gas or oil.
Hydrocarbons:		Faint trace of gas in cuttings, 180' -200' and 522'-537'
		Faint trace of gas in drilling mud, 265'-275', 285', and 455' -465'
		Poor trace of oil fluorescence, 525'-535'
		Trace to good shows of oil fluorescence from 3375'-3815'
		Small blobs of tarry, residual oil in cores at 3540'-3550' and 3815'-3825', and occuring sporadically from 3058'-3882'
		Good indications of gas from 3250' -3882'

Major Reference used in present study

Australian Oil and Gas Corporation Limited, N.S.W. 1963 - Loder No. 1 Well Completion Report (unpubl), by R.G. Perry and J. Stuntz.

Summary of Major Reference

"The Loder No. 1 well, located about 85 miles north of Sydney, was drilled in an area where Permian rocks crop out in the Hunter River Valley along the northern side of the Permo-Triassic Sydney Basin, New South Wales.

"The bore hole penetrated sediments of Permian age between 0' and 3882' and a volcanic sequence, comprised of lavas and tuffs, of probable Permian age between 3882' and total depth of 6767'.

"The recording of oil and gas shows and the proving of reasonably thick sections of promising source rock, notably in the Rutherford Formation, are regarded as positive contributions to the search for petroleum in the Sydney Basin. The arenites encountered in the Well, however, were too tight to act as reservoir beds.

"The stratigraphic units actually intersected by the drill hole are compared.....with the predicted units as anticipated from outcrop sections on the Lochinvar Anticline. The most marked difference relates to the occurrence, in the bottom part of the well, of an unexpectedly thick section of bedded volcanics.

"The volcanic section encountered in the Loder No. 1 Well, while correlatable on a rock type basis with the Allandale Formation, is probably the time equivalent of the Allandale and part of the underlying Lochinvar Formation. These two units appear to represent a section in the lower part of the Permian Dalwood Group which is composed essentially of interwedging volcanic beds and marine sediments. Consequently the proportion of sediments to volcanics in the section can be expected to change repidly from place to place."

Methods used

(a) Examination of cuttings and core samples. The cuttings samples were examined using a low power binocular microscope, and the results plotted on Petrographic Well Log sheets at a scale of 1" - 100' (Plates 1A-D). Thin sections from selected intervals were examined with the petrological microscope, and these results were also plotted on the above log.

The cores were slabbed and examined under the binocular microscope, and these results together with the thin section studies of selected core samples were plotted on Petrographic Core Log sheets (Plates 2A-D). This part of the study was done initially by L.E. Kurylowicz; but additional thin section work has been carried out, and the logs have been redrawn.

Eighteen rock units were recognised in the sedimentary and volcanic sequence. They were numbered from the surface, and each unit number prefixed by the letter "L" the code letter for this well. Five major groupings of units were established on lithogenic grounds. A summary of the rock units is shown in Fig. 1.

The specific rock names used are from the sedimentary rock classification of Pettijohn (1957); the one modification is the use of the term "quartz greywacke" for sandstone with 75% quartz in the frame work, but with 15% matrix.

(b) Calcimetry was carried out by G. Parker. Cuttings of the main lithology were selected at 100' intervals through the sedimentary sequence, only omitting the coal measures. The results of the calcimetry were plotted on the Petrographic Well Log.

(c) Differential Thermal Analysis D.T.A. was carried out by I.K. Kraitsowits. The results are set out below:-

Carbonate Analysis

1109-19' (core 4) - 6.7% Dawsonite $Na_3 Al(CO_3)_3 2Al(OH)_3$

1600-10' (cuttings) - 27.0% " " " " " "

Clay Analysis

3000 - 30'	(cuttings)	Illite (?) fresh water variety
3300	(cuttings)	" (?) marine variety
4350-80'	(cuttings)	" (?) Marine "

There were structural differences between the illite from 3000-30' to that from 3,300 and 4350-80', According to Kraitsowits, such differences are possibly related to the environment of deposition - fresh water in the former case and marine in the latter two.

Brief Notes on Dawsonite

Mineralogical description. The following description is taken from Dona (1958):-

Name: Dawsonite

Composition: Basic carbonate of aluminium and sodium $Na_3 Al(CO_3)_3 2Al(OH)_3$

System: Orthorhombic

Form: Thin encrustations of white radiating acicular or bladed crystals.

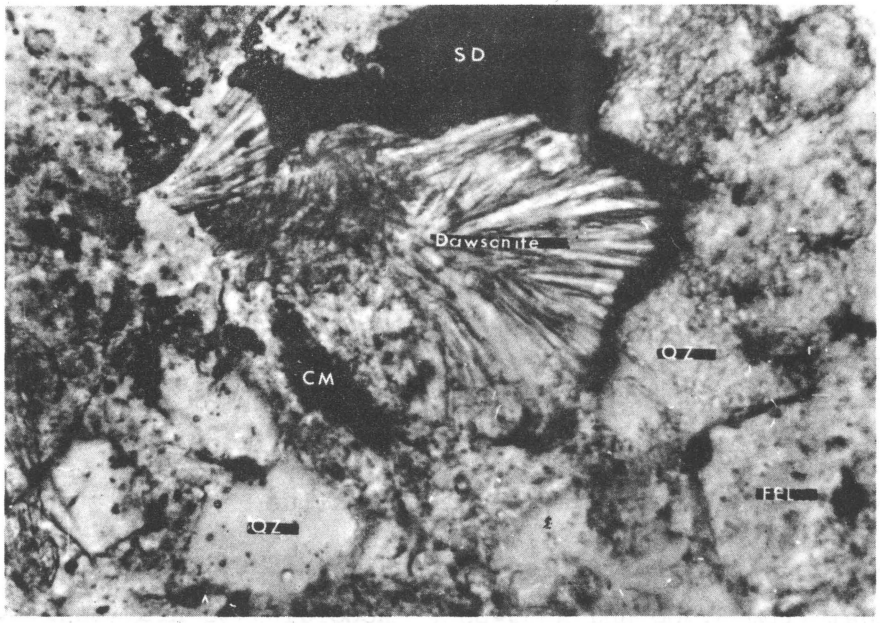
Cleavage: Perfect (010)

Optical properties:

$\alpha = 1.466$

$\beta = 1.542$

$\gamma = 1.596$



Photomicrograph No. 1 Photomicrograph showing radiating aggregate of dawsonite togehter with quartz (QZ), felspar (FEL), siderite (SD) and carbonaceous matter (CM). Loder (AOG) No. 1, Core 5 (1395'-95'4"). Plane polarised light, x60 Photograph by I.K. Kraitsowits.

Dawsonite has been identified with X-Ray Diffraction by the B.M.R. in Kurrajong Heights No. 1 well. It has been identified optically in Loder (AOG) No. 1 - see Photomicrograph and in Belford (A.O.G.) No. 1 and East Maitland (Planet) No. 1 wells.

Geology

Units L 1-3

This sequence extends from the surface to 2260' and has been subdivided into three units. It consists of a monotonous sequence of lithic sandstone, with minor siltstone interbedded in parts. Quartz, chert, quartz sandstone, and rare limestone pebbles occur throughout, but decrease upwards. Carbonaceous matter is present throughout, though sparse in the top 800' of Unit L1. Secondary silicification occurred in most places, but carbonate was the dominant cement; siderite and dawsonite were the principal cements except in the top 200' of L1 where calcite was also common. Pyrite occures throughout except in the top 200', it shows a steady upward decrease.

Wire-line logs were of only limited use in subdividing this 2260' interval. Resistivity, Sonic and Microlog were all utilised but the S.P. was found to be quite useless. On the Petrographic Well Log, the Microlog has been drawn instead of the normal S.P. trace.

The sediments were deposited in a shallow water marine environment, with lithological differences possibly due to minor fluctuations in sea level. They have been equated with the Branxton Sub-Group by the Company A.O.G. (1963).

Unit L 1 (Plate 1A).

Characteristics: This unit extends from the surface to 1570'; it consists of a sequence of sub-greywacke and protoquartzite, very fine to medium grained and with siltstone interbeds from 960' to 1,090'. Coal is scattered through the lower 700', and at one place probably forms a minor seam; this is also indicated on eht Sonic log. Cores from this unit show mainly disrupted bedding, churned by burrowing organisms. Brachiopod shells and spines and fenestellid bryozoa occur commonly above 600', but become sparser below. Other characteristics have been referred to under the description of the major unit.

Boundary criteria: The lower boundary of the unit is marked by an increase in carbonate (dawsonite) cement and pyrite, and by a matching sharp increase in resistivity on both microlog and resistivity logs.

Environment and provenance: Shallow water, marginal marine conditions existed throughout the deposition of the unit. The presence of carbonaceous matter, abundant siderite, together with the churned bedding and evidence of burrowing organisms and the sparseness of marine fossils, all suggest a more restricted and somewhat reducing environment for the lower half of the unit; conditions were better aerated higher in the unit, with plentiful bryozoa and less carbonaceous material. The moderate sorting and plentiful pebbles and pebble bands throughout, suggest that moderate currents existed for much of the time. The provenance appears to be dominantly sedimentary, but the presence of accessory amounts of plagioclase, muscovite, zircon and rare microcline indicate the possibility of a subsidiary granitic provenance.

Unit L2 (Plates 1A,B.)

Characteristics: This unit extends from 1570' to 1810'; it consists of fine grained, well cemented sub-greywacke, grading in parts to medium-grained protoquartzite. There are some siltstone partings, and the base of the unit is rich in pebbles of quartz, chert, and sandstone. Pyrite and carbonaceous material is present throughout, and a possible metaquartzite lithic was observed. The unit is well cemented with dawsonite and silica, the dawsonite being particularly abundant toward the top. The Resistivity and Sonic logs show a very distinctive "saw tooth" pattern, quite different from both the overlying and underlying units.

Boundary criteria: The lower boundary has been placed at the base of the pebbly band at 1810'. There is also a reduction of siderite and silica cement and pyrite at this point. Below this level, the [redacted]-line logs show much less fluctuation - though the mean values are very similar.

Environment and provenance: A shallow water marginal marine environment is envisaged for this unit, with moderate current action during the deposition of the lower part; conditions became quieter toward the top of the unit, where there is an increase in coal and carbonaceous matter. The provenance appears to be dominantly sedimentary, but the presence of accessory amounts of plagioclase, zircon, and rare microcline indicate the possibility of a subsidiary granitic provenance.

Unit L 3 (Plate 1B)

Characteristics: This unit extends from 1810' to 2260' and consists of well cemented protoquartzite with very variable content of pyrite; carbonaceous material is less common than in Unit L 2. Rare coal fragments occur and vein calcite is common in the lower part. Pebbles are present throughout, but tend to be concentrated towards the upper and lower limits of the unit. Dawsonite and silica cement are reduced in the lower part. Core 6 (1852' to 1862') has finely laminated and churned bedding and contains sparse volcanic lithics. The sonic and resistivity logs show very steady readings comparable to the mean values in the overlying Unit L 2.

Boundary Criteria: The lower boundary is marked by increases in coal and in chert lithics, and the appearance of volcanic lithics and a clay matrix. These lithological changes are accompanied by a local drop of resistivity and in sonic velocity.

Environment and provenance: The sediments were deposited under shallow marginal marine conditions. The pebble bands and pebbles throughout suggest moderate current action. The sparseness of marine fossils, and presence of siderite and carbonaceous material indicate a restricted, somewhat reducing, environment. A dominantly sedimentary provenance is suggested, with the possibility of subsidiary granitic and volcanic indicated by the sparse volcanic pebbles, and accessory amounts of muscovite and zircon.

Unit L 4

Characteristics: This unit extends from 2260' to 2540' and consists of a series of five thin coal seams associated with cherty lithic sandstone and a lithic conglomerate.

Difficulty was experienced in reconciling the Cuttings Percentage Log with the Sonic Log fluctuations - apparent on Plate 1B. However a later examination of duplicate set of cuttings revealed a big discrepency in the cuttings from this interval. The duplicate set of cuttings from the same interval was clearly far more reliable and this information was used for the Interpreted Lithology on plate 1B.

The top seam is overlain by a carbonaceous protoquartzite, chert and clay lithics, and rests on a conglomerate that grades upwards to a carbonaceous sub-greywacke. The conglomerate contains pebbles of quartz, chert, quarts sandstone and volcanics; it is well cemented with siderite. The sub-greywacke is pyritic, sideritic and carbonaceous. This sequence appears to be equivalent to the Greta Conglomerate and Greta Seam as described elsewhere in the Hunter Valley. (F.W. Booker 1960)

Beneath the conglomerate is a series of thin coal seams with partings of pebbly, pyritic, carbonaceous well cemented protoquartzite containing abundant chert lithics and grading to siltstone in parts. This sequence is possibly equivalent to the Homeville Seam as described elsewhere in the Hunter Valley (F.W. Booker 1960).

Boundary Criteria: The lower boundary is marked by a lithological change from the coarse-grained pebbly protoquartzite associated with the coal seams, to the finer grained better sorted lithic sandstone of the underlying unit. At this level, the wire-line logs show a steadying of values indicating an absence of coal seams and a much more uniform lithology below.

Environment and provenance: The coal in the Greta Coal Measures is considered to be, most likely, allochthonous (F.W. Booker 1960), lacking underclays, and in which "Plant stems of any size are rare and large stems standing vertical to the bedding planes are unknown." This hypothesis is supported by the present study. A mainly sedimentary provenance is suggested for the conglomerate and lithic sandstones, with a subsidiary volcanic and minor metamorphic source.

Units L 5-6

This sequence extends from 2,540' to 3,058' and was deposited under shallow water marine conditions, during a period of regression, culminating in the development of coal in the overlying unit.
It has been divided into two units; the lower consists of a feldspathic sandstone interbedded with siltstone, and the upper unit is a protoquartzite.

Unit L 5 (Plate 1B)

Characteristics This unit extends from 2,540' to 2,960', and consists of a very fine to fine grained protoquartzite, containing coal fragments and carbonaceous material, clay lithics, rare volcanic and metaquartzite lithics; quartz, chert and rare volcanic pebbles occur - abundant at the base of the unit but decreasing upwards. The cements are calcite and siderite with minor dawsonite. Toward the top of the unit there is no calcite, and there the cements are silica and siderite. Pyrite is present toward the top of the unit, and there is also a lens of sideritic sandstone. The wire-line logs show a fairly even resistivity - very similar to the pattern for Unit L 3; the sonic curve is relatively smooth and the few small peaks are associated with higher concentration of carbonaceous material.

Boundary criteria: The lower boundary is marked by a lithological change to feldspathic sandstone. There is a local increase in resistivity and velocity in sonic.

Environment and provenance: The sediments were deposited in a shallow water, marginal, probably backish environment, with current action decreasing over the period of deposition. A mainly sedimentary provenance is suggested, with a subsidiary granitic source indicated by the accessory amounts of plagioclose and zircon; there is a possibility of minor metamorphic and volcanic sources,

Unit L 6 (Plate 1B)

Characteristics: This unit extends from 2960' to 3,058' and consists of a very fine to fine grained feldspathic sandstone interbedded in part with a coarse grained siltstone. The sandstone contains volcanic and clay lithics, and coal and plant fragments; this is the uppermost unit in which volcanic lithics are common. The cements are siderite and dolomite. The siltstone is pyritic and carbonaceous.

The wire-line logs are marked by strong fluctuations, reflecting the sandstone - the sandstone shows increased resistivity compared with that in Unit L 5.

Boundary criteria: The lower boundary is marked by a lithological change to a darker grey lithic sandstone with siltstone partings, and by a decrease in resistivity and sonic velocity.

Environment and provenance: A marginal, shallow, brackish to marine environment is postulated for this unit. Core 9 contains sparse marine fossils in addition to plant fragments, also and evidence of burrowing. The provenance is mainly sedimentary with subsidiary volcanic and granitic influences.

Unit L 7 (Plate 1B C)

Characteristics: This unit extends from 3,058' to 3,882' and consists of poorly bedded, pyritic, carbonaceous siltstone increasing in grain size up the sequence. Locally fine sandstone occurs at a number of levels, and the top of the succession is a fine sandstone with siltstone partings. Shell fragments occur together with volcanic and clay lithics. There are scattered pebbles throughout, and calcite and siderite cement. Cores 10 (3,220' to 4029') 11 (3,540' to 3550') and 12 (3,815' to 3,825') all show churned bedding. Burrows were observed in Core 10, and poorly preserved bivalves in Cores 11 and 12.

The wire-line logs reflect the interbedding where it occurs; but otherwise the logs are rather featureless and show a steady low resistivity and high sonic velocity.

Boundary criteria: The lower boundary is marked by a lithological change to the basalt at the top of the underlying volcanic sequence, and an increase in resistivity and sonic velocity.

Environment and provenance: A near shore, possibly tidal flat environment for the deposition is suggested for this unit. Sedimentary, granitic and volcanic sources all contributed detritus.

Units L 8 - 18

Units L 8 to 18 consist of a sequence of intermediate to basic volcanics extending from 3,882' to 6767' (T.D.). The units have been delineated mainly on the basis of thin section examination, supported by the wire-line logs.

Unit L 8 (Plate 1 C)

Characteristics: This unit extends from 3,882' to 4,050' and consists of an altered zeolitic, pyritic basalt.

Boundary Criteria: The lower boundary is marked by a lithological change to an agglomerate, and a change in the character of the resistivity log from a broad "saw tooth" pattern to a steady featureless trace.

Unit L 9 (Plate 1 C)

Characteristics: This unit extends from 4,050' to 4,590' and consists of an agglomerate made up of vuggy andesite.

Boundary outline: The lower boundary is marked by a lithological change to a conglomerate; there is a corresponding sharp increase in resistivity and in sonic velocity.

Unit L 10 (Plate 1 C)

Characteristics: This unit extends from 4,590' to 4,740' and consists of a conglomerate containing pebbles of chert, altered andesite basalt, and possible metaquartzite.

Boundary criteria: The lower boundary is marked by the change to a tuff; there is also a decrease in resistivity, although the overall pattern of the wire-line log is not very different in the underlying unit.

Unit L 11 (Plate 1 C)

Characteristics: This unit extends from 4,740' to 4,900' and consists of a lapilli tuff with trachytic textured fragments and some very fine-grained sedimentary lithics. Vughs are very common, filled with chlorite and chalcedonic silica.

Boundary criteria: The lower boundary is marked by a change to conglomerate and a slight increase in resistivity.

Unit L 12 (Plate 1 C)

Characteristics: This unit extends from 4,900' to 4,985' and consists of interbedded conglomerate and lapilli tuff, both lithologies similar to those described in units 10 and 11.

Boundary criteria: The lower boundary was placed at a change observed in the cuttings from dark green to reddish brown volcanics. There is also a sharp decrease in sonic velocity.

Unit L 13 (Plate 1 C)

Characteristics: This unit extends from 4,985 to 5,230'. It has been tentatively designated a tuff - similar to that of Unit L 11 - because of the similarity in resitivity and sonic responses.

Boundary Criteria: The lower boundary is marked by the change to an andesite; there is also a sharp increase in resistivity below this level.

Unit L 14 (Plate 1 C)

Characteristics: This unit extends from 5,250' to 5,245' and consists of an andesite with a fine-grained devitrified glass matrix. It contains feldspar phenocrysts (altered to carbonate(, and pyroxene (altered to epidote).

Boundary Criteria: The lower boundary is marked by a change seen in the cuttings from grey-green to orange-red volcanics, and by a decrease in resistivity and sonic velocity.

Unit L 15 (Plate 1 C)

Characteristics: This unit extends from 5,345' to 5,00' and consists of orange-red, to grey-green volcanics - possibly tuff or agglomerate.

Boundary Criteria: The lower boundary is marked by a change to a grey-black volcanic rock. There is also a change to a [redacted] fluctuating sonic response.

Unit L 16 (Plate 1 C)

Characteristics: This unit extends from 5,500' to 5,520' and consists of a relatively fresh basalt.

Boundary Criteria: The lower boundary is marked by a lithological change from the grey-black basalt, to reddish-grey highly altered volcanics.

Unit L 17 (Plate 1 C and D)

Characteristics: This unit extends from 5,520' to 5,745' and is a very altered sequence of intermediate to basic volcanic rocks in which chlorite and hematite are common.

Boundary Criteria: The change in lithology to a distinctive tuff. There is also a sharp decrease in resistivity and in sonic velocity on the wire-line logs.

Unit L 18 (Plate 1C, D.)

Characteristics: This unit extends from 5,745' to 6,767' (T.D.). It is predominantly a tuff. Thin sections from Core 18 (5803'-11'), Core 19 (6296-99') and Core 20 (6761' to 67') are all tuffs, though part of lapilli tuff. Core 19 is a lapilli tuff at the top, but the rest of the core is an altered andesite. Core 20, at the bottom of the well is a lapilli tuff. The wire-line log characteristics in the upper half of the sequence are very uniform and very similar to those of Unit L 9, and to the lower half of Unit L 11. It is therefore considered that although the unit may contain minor flows, it is mainly tuffaceous.

Boundary Criteria: The unit extends to the bottom of the well.

CONCLUSIONS

Degree of agreement with Well Completion Report.

A comparison between unit boundaries chosen in this study, and the stratigraphic subdivisions set out in the Well Completion Report (A.O.G., 1963) is given in Fig. 2.

The major unit L 1-3 corresponds to the Branxton Sub-Group as defined by the Company. Unit L 4 is a equivalent to the Greta Coal Measures, with the difference that the Company has placed the base at 2,580', while the base of Unit L 4 is at 2,540'. The Company took the base from the Sonic Log...." where a sharp change in velocity values occurs, and is supported by a change in resistivity on the electro-log". In the present work, the base was placed at a lithological change from the coarse-grained pebbly sandstone of the Unit L 4 coal measures and the finer grained, better sorted sandstone of the underlying Unit L 5.

Units L 5 and 6 are comparable to the Farley Formation as defined by the Company except for the difference in the upper boundary referred to above.

Unit L 7 can be equated to the Rutherford Formation and Units L 8 and 18 to the Allandale Formation.

Summary of New Data

As detailed above, the total section consists of 3,882' of sediments underlain by 2,885' of predominantly basic to intermediate volcanics. The sediments have been divided into eighteen lithological units representing two phases of marine deposition separated by a fresh water sequence.

In the lower marine phase there is a transition from siltstone with calcite and siderite cement, to sandstone with dawsonite and siderite cement.

Dawsonite and siderite cements persist through the fresh-water and upper marine sequence, with calcite playing little or no part as a cementing agent. It is suggested that the dawsonite was precipitated penecontemporaneously along with the siderite.

Volcanic lithics are present in the siltstone of the lower marine sequence and in the lower sandstone unit. They were observed in the Coal Measure conglomerate, and rarely in the lower part of the upper marine sequence.

Possible influence of new data on hydrocarbon prospects

It would seem that Unit L 1 may have some value as a reservoir rock, and Unit L 7 as a source rock. The other units are considered to be too tight, or of unsuitable character to act either as source or reservoir rocks.

REFERENCES

A.O.G. 1963 - Loder No. 1 Well Completion Report, (unpubl.).

Booker F.W., 1960 - Studies in Permian Sedimentation in the Sydney Basin. N.S.W. Dept. of Mines Tech. Rep. vol. 5 pp 10-62.

Dana E.S., 1958 - A Textbook of Mineralogy, John Wiley, New York

WELL NAME, No. LODER (A.O.G.) No. 1.
OPERATING Co. A. O. G.
WELL LOCATION
Lat.: 32° 38' 07"S. Long.: 151° 08' 00"E.
Basin SYDNEY
State N.S.W.
Tenement No. P.E.L. 9
1:250.000 Sheet No. S I 56 1

ELEVATION (A.S.L.)
: Ground Level 338·10 ft.
: K.B. Datum 355·15 ft.

SAMPLE STORAGE
: B.M.R., Canberra

HYDROCARBON SYMBOLS
⊖ Trace of oil
Trace of gas
◇ Fluorescence

MISCELLANEOUS
Interval and Number of Formation Test
No sample available from interval

0 — 100 — 200 ft.

PETROGRAPHIC WELL LOG
LODER (A.O.G.) No. 1

Geology by E. Nicholas.

Volcanic Agglomerate Breccia, Lapilli tuff
Volcanic Interm.
Tuff, Fine Tuff
Volcanic Basic
Volcanic undiff.
Sed. Lithics
Iron Oxides
Siderite
Silica
Pyrite
Dawsonite

LITHOLOGICAL SYMBOLS
Breccia to conglomerate
Quartz sand, sandstone
Siltstone
Claystone
Limestone
Dolomite
Coal
Shale and mudstone
Calcirudite
Calcarenite
Calcilutite

MINERAL ABBREVIATIONS

Ca	Calcite	Si	Silica
Dol	Dolomite	Microcl	Microcline
Sd	siderite	Hem	Hematite
Da	Dawsonite	Chlor	Chlorite
Fe	Iron oxide	Zeo	Zeolite
Py	Pyrite	Epi	Epidote
Musc	Muscovite		
Serc	Sericite		
Orth	Orthoclase		
Bi	Biotite		

* See Report

Plate 1A

DEPTH (feet) from datum
FOSSILS (R - rare C - common A - abundant X - present) — Spines, Bryozoa
CARBONATE % LOG (Dil. HCl Test) (1 min reaction) (10 min reaction) Approx. Wt %
GRAIN SIZE (Wentworth Scale) Estim. size range & mode — Clay, Silt, Very fine, Fine, Medium, Coarse, Very coarse, Pebble — Sands
POROSITY (estim.) (Excluding silt - Size) — Poor 5-10%, Mod 10-15%, Good 15-20%
LITHOLOGIES AND % OF CUTTINGS
THIN - SECTIONS
DESCRIPTIONS OF CUTTINGS (Description ③ refers to lithological pattern ③ at corresponding depth)
PHOSPHATE CONTENT Test (Molybdate Test) — Nil, Trace, Low, Mod, High
INTERPRETED POROSITY Cores - Cuttings — Slight < 6%, Poor 6-10%, Mod 12-20%, Good > 20%
MICROLOG — Mix 1" HN 2"
HYDROCARBONS CORES (Key to symbols above)
INTERPRETED LITHOLOGY (Key to symbols above)
RESISTIVITY Ohms m²/m
INTERVAL TRANSIT TIME MICROSECONDS PER FOOT SONIC SPACING 3 FEET
KEY MINERALS — Clasts, Cement, Matrix — Formation Test Data
DESCRIPTION OF INTERPRETED LITHOLOGY — Rock Name (after Pettijohn, 1957)

B.M.R. UNITS — DESCRIPTION, MINOR UNIT, MAJOR UNIT
COMPANY INTERPRETATION — FORMATION, GROUP, AGE

100 200 300 400 500 600 700 800 900 1000 1100 1200 1300 1400 1500 1600 1700

1. PALE YELLOW SANDSTONE. FERRUGINOUS. SILT LITHICS. MICA. SCATTERED QUARTZ AND CHERT PEBBLES TO 1%. CALCITE.
2. MEDIUM GREY FOSSILIFEROUS SANDSTONE SILT LITHICS. CHERT. MICA. DAWSONITE. CALCITE. SIDERITE. SPARSE CARBONACEOUS LITHICS. PEBBLES OF QUARTZ AND CHERT TO 1%.
3. LIGHT BROWN SANDSTONE SIMILAR TO 1.
4. MEDIUM DARK GREY SANDSTONE. SILT LITHICS. MICA. RED CHERT. SIDERITE. DAWSONITE.
5. MEDIUM LIGHT GREY SANDSTONE. SILT LITHICS GREEN CHERT. SIDERITE.
6. MEDIUM GREY SANDSTONE. FOSSILIFEROUS. SILT LITHICS. MICA. CALCITE. SIDERITE. DAWSONITE. RARE PYRITE. QUARTZ AND CHERT PEBBLES TO 2%.
7. MICACEOUS SHALE WITH SILTY STRINGERS.
8. MEDIUM LIGHT GREY SANDSTONE. CARBONACEOUS MATTER AND SILT LITHICS. DAWSONITE. (LESS THAN IN 6.) MICA. RED AND GREEN CHERT. COAL FRAGMENTS. PEBBLES TO 2%.
9. MEDIUM GREY SANDSTONE. SILTY CARBONACEOUS LITHICS RARE FOSSILS. PEBBLES.
10. LIGHT GREY SANDSTONE. CARBONACEOUS MATTER AND SILT LITHICS. GREEN CHERT. COAL FRAGMENTS. PEBBLES TO 5%.
11. SILTSTONE. DARK GREY. CARBONACEOUS MATTER. RARE BRYOZOA.

CLEAN QUARTZ SAND 1140-50.

CLEAN QUARTZ SAND 1280-90.

12. LIGHT GREY SANDSTONE. CARBONACEOUS MATTER AND SILT LITHICS. CHERT. SIDERITE. DAWSONITE. CALCITIC LITHICS. VEIN CALCITE INCREASING BELOW 1460. COAL FRAGMENTS. PEBBLES IN GENERAL TO 10% BUT REACH 50% IN ONE INTERVAL.
13. SANDSTONE AS FOR 12 BUT WITH MINOR CARBONACEOUS SILTSTONE. DAWSONITE. PEBBLES TO 1%.
14. LIGHT GREY SANDSTONE. SILT LITHICS. PYRITE. DAWSONITE.
15. LIGHT GREY SANDSTONE. CARBONACEOUS MATTER AND SILT LITHICS. SIDERITE. DAWSONITE. COMMON PYRITE. COAL FRAGMENTS. PEBBLES TO 5%.

SUBGREYWACKE. YELLOW BROWN. FOSSILIFEROUS. PEBBLES TO 1%.
SUBGREYWACKE. MED GREY. FOSSILIFEROUS. SPARSE CARBONACEOUS MATTER. PEBBLES TO 1%.

SUBGREYWACKE. MED DARK GREY. PYRITE. PEBBLES TO 1%. INTERBEDDED WITH FERRUGINOUS SUBGREYWACKE AS ABOVE.

SUBGREYWACKE. MED GREY. SPARSE CARBONACEOUS MATTER AND PYRITE. PEBBLES TO 2%.

PROTOQUARTZITE. MED GREY. SIDERITE DOMINANT CEMENT. PEBBLES TO 2%.

SUBGREYWACKE. MED GREY. CARBONACEOUS MATTER. SIDERITE CEMENT. PEBBLES TO 2%.

PROTOQUARTZITE. MED GREY. PEBBLES TO 2% INCLUDING ERRATICS. INTERBEDDED MICACEOUS SHALE.

PROTOQUARTZITE. MED GREY. DAWSONITE DOMINANT CEMENT. PEBBLES TO 2%.

PROTOQUARTZITE. MED TO MED-LIGHT GREY. POSSILIFEROUS. WELL CEMENTED WITH SIDERITE DAWSONITE AND SILICA CEMENT. CARBONACEOUS MATTER. PEBBLES TO 2%.

PROTOQUARTZITE. LIGHT GREY. INTERBEDDED CARBONACEOUS SANDY SILTSTONE. COAL LITHICS AND MINOR COAL SEAM. SILTSTONE IS FOSSILIFEROUS. PEBBLES TO 5%.

CLEAN QUARTZ SAND.
LITHIC SANDSTONE. LIGHT GREY. PEBBLY AND SILTY IN PARTS.

CLEAN QUARTZ SAND.
PROTOQUARTZITE. LIGHT GREY. PEBBLE BANDS. WELL CEMENTED WITH SIDERITE DAWSONITE AND SILICA CEMENT. VEIN CALCITE COMMON FROM 1460-1550.

SUBGREYWACKE. LIGHT GREY. VERY WELL CEMENTED WITH DAWSONITE.
PROTOQUARTZITE. LIGHT GREY. WELL CEMENTED WITH DAWSONITE AND SILICA. PEBBLES DECREASE UPWARDS IN THIS UNIT.

Lithic sandstones with minor siltstone, containing carbonaceous matter and pebbles, and calcite, siderite, dawsonite and silica cement.

L1
L 1-3
L2

BRANXTON SUB-GROUP
MAITLAND
PERMIAN

B.M.R. Petroleum Exploration January 1968.

X AUS – I – 60A

DEPTH (feet) from datum

FOSSILS — R - rare C - common A - abundant X - present — 1 Bryozoa 2 Shell Fragments 3 Plant Fragments

CARBONATE % LOG — (Dil HCl Test) — (1 min reaction) — (10 min reaction) — Approx Wt %

GRAIN SIZE (Wentworth Scale) — Estim. size range & mode — Sands: Clay - Silt, Very Fine, Fine, Medium, Coarse, Very Coarse, Pebble

POROSITY (estim.) — Silt < 12½%, Fair 6-12½%, Good > 12½% — (Excluding silt - size) — 50%

LITHOLOGIES AND % OF CUTTINGS

THIN - SECTIONS

DESCRIPTIONS OF CUTTINGS

(Description (3) refers to lithological pattern (3) at corresponding depth)

PHOSPHATE CONTENT (Molybdate Test) — Nil, Trace, Low, Med., Hi

INTERPRETED POROSITY Cores - Cuttings — Sh < 6% Poor 6-12% Med 12-20% Good > 20%

MICROLOG

HYDROCARBONS CORES (Key to symbols above)

INTERPRETED LITHOLOGY (Key to symbols above)

RESISTIVITY Ohms m²/m — 0 — 50

INTERVAL TRANSIT TIME MICROSECONDS PER FOOT — SPACING 3 FEET — 90 — 40

SONIC — Clasts — Cement, Matrix

KEY MINERALS

DESCRIPTION OF INTERPRETED LITHOLOGY

Formation ← — Test Data — Rock Name (after Pettijohn, 1957)

B.M.R. UNITS — DESCRIPTION — MINOR UNIT — MAJOR UNIT

COMPANY INTERPRETATION — FORMATION — GROUP — AGE

1800 1900 2000 2100 2200 2300 2400 2500 2600 2700 2800 2900 3000 3100 3200 3300 3400 3500 3600 3700

15. SANDSTONE AS ABOVE.
16. SANDSTONE.. MED DARK GREY. PYRITE AND CARBONACEOUS MATTER.
17. SANDSTONE. LIGHT GREY. CARBONACEOUS MATTER AND SILTSTONE LITHICS. PEBBLES TO 2%. SIDERITE AND DAWSONITE CEMENT.
18. SANDSTONE. MED GREY. PYRITE AND CARBONACEOUS MATTER. SCATTERED PEBBLES OF CHERT AND QUARTZ, AND PEBBLE BANDS. VEIN CALCITE FROM 1996. FRAGMENTS OF COAL.

18a. AS ABOVE. INCREASED SILT AND PEBBLES BECOMES BIMODAL.

19. SANDSTONE, MED GREY. PYRITIC AND CARBONACEOUS.

19a. PETROMICT CONGLOMERATE.
20. LIGHT GREY SANDSTONE WITH GREEN, GREY AND BLACK CHERT, PYRITE AND CARBONACEOUS MATTER. COAL FRAGMENTS, DAWSONITE AND SIDERITE CEMENT.

21. SANDSTONE. LIGHT GREY. FINER GRAINED AND BETTER SORTED THAN 20.

SIDERITIC SANDSTONE.
21. AS ABOVE. PEBBLES OF QUARTZ, CHERT, AND COARSE SANDSTONE TO 5%.

21. AS ABOVE. VOLCANIC LITHICS OBSERVED FROM 2960 PEBBLES TO 10% GENERALLY, TO 20% IN ONE INTERVAL.

22. SILTSTONE. DARK GREY. PYRITE AND CARBONACEOUS MATTER FINELY DISPERSED AND IN THIN STREAKS.
23. SANDSTONE. MED DARK GREY. COMMON PYRITE. CARBONACEOUS MATTER. VOLCANIC LITHICS. SIDERITE CEMENT.
24. SILTSTONE. DARK GREY. VOLCANIC LITHICS. MICA. CALCITE CEMENT.

25. SANDSTONE. FINELY DISPERSED SILT. SHELL FRAGMENTS. PYRITE. SIDERITE CEMENT.
26. SILTSTONE. MED GREY. SIDERITE AND CALCITE CEMENT.

27. SILTSTONE. MED GREY. MICACEOUS. BRIGHT COAL LITHICS. VOLCANIC LITHICS SHELL FRAGMENTS. FINELY DISPERSED PYRITE. VEIN CALCITE. QUARTZ AND CHERT PEBBLES TO 5%.
28. SANDSTONE. CARBONACEOUS MATTER. VOLCANIC AND SILTSTONE LITHICS. PYRITE. CALCITE CEMENT.

29. SANDSTONE. MED GREY. CARBONACEOUS STRINGERS. SHELL FRAGMENTS. FINELY DISPERSED PYRITE.

FINE GRAINED SUBGREYWACKE WITH CARBONACEOUS PYRITIC SILTSTONE PARTINGS AND ABUNDANT CHERT LITHICS.

CARBONACEOUS PYRITIC PEBBLY PROTOQUARTZITE.

PROTOQUARTZITE. VARIABLE CONTENT OF CARBONACEOUS MATTER, SILT AND PYRITE. VEIN CALCITE COLLION. PEBBLE BANDS, AND SCATTERED PEBBLES TO 5%. SPARSE VOLCANIC LITHICS IN CORE 6.

PROTOQUARTZITE. INCREASE IN PEBBLES, OTHERWISE AS ABOVE.
PROTOQUARTZITE. COAL, VOLCANIC AND CLAY LITHICS. ABUNDANT CHERT LITHICS.

PETROMICT CONGLOMERATE, WELL CEMENTED, GRADING TO PYRITIC, SIDERITIC, CARBONACEOUS SUBGREYWACKE AND BITUMINOUS COAL.
THIN COAL SEAM, RESTING ON PEBBLY PROTOQUARTZITE WHICH IS WELL CEMENTED, PYRITIC AND CARBONACEOUS.

BITUMINOUS COAL SEAMS, WITH PARTINGS OF CARBONACEOUS PYRITIC PROTOQUARTZITE AND SILTSTONE WITH ABUNDANT CHERT LITHICS.

PROTOQUARTZITE. LENS OF SIDERITIC SANDSTONE. SEDIMENTARY LITHICS. COAL AND CARBONACEOUS MATTER.

PROTOQUARTZITE. COAL AND CARBONACEOUS MATTER. INCREASE IN PEBBLES. SIDERITE, DAWSONITE, AND CALCITE CEMENT.

FELDSPATHIC SANDSTONE. VOLCANIC LITHICS. MINOR PYRITE AND CARBONACEOUS MATTER. SIDERITE AND DOLOMITE CEMENT. SOME INTERBEDDING OF CARBONACEOUS SILTSTONE.

COARSE GRAINED, SANDY SILTSTONE. MICACEOUS, CARBONACEOUS AND PYRITIC. VOLCANIC LITHICS AND SHELL DEBRIS. GRADES IN PARTS TO FINE SANDSTONE AND MEDIUM GRAINED SILTSTONE.

FINE SILTSTONE. CONSTITUENTS AS ABOVE. GRADES IN PARTS TO FINE SANDSTONE.

Lithic sandstones with minor siltstone containing carbonaceous matter and pebbles and calcite, siderite dawsonite and silica cement. — L3 — L1-3

Thin coal seams associated with cherty lithic sandstone and petromict conglomerate. — L4 — L4

Feldspathic sandstone with volcanic lithics, interbedded coal fragments and carbonaceous matter. — L5 — L5-6

Fossiliferous, pyritic, carbonaceous siltstone with volcanic lithics and grading in parts to fine sandstone. — L6 — L7

BRANXTON SUB-GROUP — MAITLAND — GRETA COAL MEASURES

RUTHERFORD FORMATION — FARLEY FORMATION — DALWOOD — PERMIAN

B.M.R Petroleum Exploration January 1968.

X AUS - 1 - 60B

DEPTH (feet) from datum

FOSSILS — R- rare C- common A- abundant X- present — 1 2 3 Shell fragments 4 5 6 7 8 9 10

CARBONATE % LOG — (Dil. HCl Test) — (1 min reaction) — (10 min reaction) — Approx. Wt % 5 10 15 20 25

GRAIN SIZE (Wentworth Scale) — Estim. size range & mode — Sands — Clay - Silt, Very fine, Fine, Medium, Coarse, Very coarse, Pebble, Boulder

POROSITY (estim.) (Excluding silt - size) — Poor 0-5%, Fair 5-10%, Good 10-20%, Good > 20%

LITHOLOGIES AND % OF CUTTINGS — 50%

THIN - SECTIONS

DESCRIPTIONS OF CUTTINGS

(Description ③ refers to lithological pattern ③ at corresponding depth)

PHOSPHATE CONTENT — Nil — Traces, Low, Mod., High

INTERPRETED POROSITY Cores - Cuttings — Slight < 6%, Poor 6-12%, Mod. 12-20%, Good > 20%

S.P. LOG — Millivolts

HYDROCARBONS CORES (Key to symbols above)

INTERPRETED LITHOLOGY (Key to symbols above)

RESISTIVITY — Ohms m²/m

SONIC — Interval transit time Microseconds per foot Spacing 3 feet.

KEY MINERALS — Clasts, Cement, Matrix

Formation Test Data

Rock Name (after Pettijohn, 1957)

DESCRIPTION OF INTERPRETED LITHOLOGY

B.M.R. UNITS — DESCRIPTION, MINOR UNIT, MAJOR UNIT

COMPANY INTERPRETATION — FORMATION, GROUP, AGE

3800

27. AS ABOVE. CARBONACEOUS, MICACEOUS, PYRITEC SILTSTONE.

29. SANDSTONE AS ABOVE 3560.

30. COARSE GRAINED SILTSTONE.

31. LIGHT AND DARK GREEN HOLOCRYSTALLINE VOLCANICS. CALCITIC.

3900

4000

32. FINER GRAINED VOLCANICS. DARK GREEN MINERAL IN MATRIX OF FINE FELDSPAR LATHS.
DARK GREEN AND BUFF COLOURED VOLCANICS WITH SPHERICAL INCLUSIONS.

4100

DARK AND LIGHT GREEN VOLCANICS. LIGHTER ONES WITH CONCENTRIC INCLUSIONS.

4200

4300

DARK GREENISH-GREY VOLCANICS, SOME AMYGDALOIDAL. COMMON CALCITE. PYRITE, MINOR RED VOLCANICS. A LITTLE SILTSTONE AND FINE SANDSTONE.

4400

DARK GREENISH-GREY, MIXED FINE AND COARSE-GRAINED VOLCANICS. CALCITIC. MINOR RED VOLCANICS.

4500

PALE GREEN AND WHITE VOLCANICS.

33. ALTERNATING BANDS OF PALE PINK AND GREEN CONGLOMERATE.

4600

34. MAINLY DARK GREEN VOLCANICS WITH MINOR BUFF, GREEN AND WHITE, AND RED.

4700

MINOR LITHOLOGY OF FINE MICACEOUS SILTSTONE WITH VOLCANIC LITHICS. PYRITIC SLICKENSIDES ON SOME FRAGMENTS.

33. PINK CONGLOMERATE AS ABOVE.

4800

4900

35. REDDISH BROWN FINELY CRYSTALLINE VOLCANICS.

ORANGE RED VOLCANICS.

5000

REDDISH GREY GREEN FINE- GRAINED VOLCANICS.

FINE-GRAINED GREEN AND WHITE VOLCANICS WITH MINOR RED.

5100

36. GREY GREEN VOLCANICS.

5200

5300

37. ORANGE RED VOLCANICS WITH WHITE INCLUSIONS (ZEOLITE).

38. GREY GREEN VOLCANICS. FINE MATRIX. DARK GREEN, WHITE AND RED INCLUSIONS.

5400

5500

39. REDDISH GREY BLACK VOLCANICS.

40. REDDISH GREY VOLCANICS.

5600

REDDISH GREY GREEN VOLCANICS. COARSER THAN ABOVE.

5700

SILTSTONE. FINE-GRAINED, GRADING IN PARTS TO VERY FINE SANDSTONE. CARBONACEOUS AND PYRITIC WITH CLAY AND VOLCANIC LITHICS.

ALTERED BASALT WITH ZEOLITE AND PYRITE.

ANDESITIC AGGLOMERATE. PREDOMINANTLY ALTERED ANDESITE WITH LARGE VUGHS

CONGLOMERATE. PEBBLES OF ALTERED ANDESITE AND BASALT. CHERT PEBBLES. METAQUARTZITE(?) PEBBLES. THE MATRIX IS SILICIFIED AND COMPOSED OF FINE MATERIAL OF BOTH VOLCANIC AND SEDIMENTARY ORIGIN.

LAPILLI TUFF. COMPOSED OF TRACHYTIC TEXTURED ANDESITE WITH SOME VERY FINE-GRAINED SEDIMENTARY LITHICS. VUGHS ARE COMMON FILLED WITH CHLORITE AND CHALCEDONY.

INTERBEDDED PINK CONGLOMERATE AND LAPILLI TUFF AS ABOVE.

PROBABLY TUFF.

ALTERED ANDESITE. FINE-GRAINED DEVITRIFIED MATRIX. FELDSPAR PHENOCRYSTS ALTERED TO CARBONATE. PYROXENE ALTERED TO EPIDOTE.

INTERMEDIATE TO BASIC VOLCANIC, POSSIBLY TUFF OR AGGLOMERATE.

BASALT.

INTERMEDIATE TO BASIC VOLCANICS WITH LARGE ALTERED PLAGIOCLASE PHENOCRYSTS.

Sequence of intermediate to basic pyroclastics and flows with one interval of fluvial deposition.

L7 L8 L9 L10 L11 L12 L13 L14 L15 L16 L17

L8-18

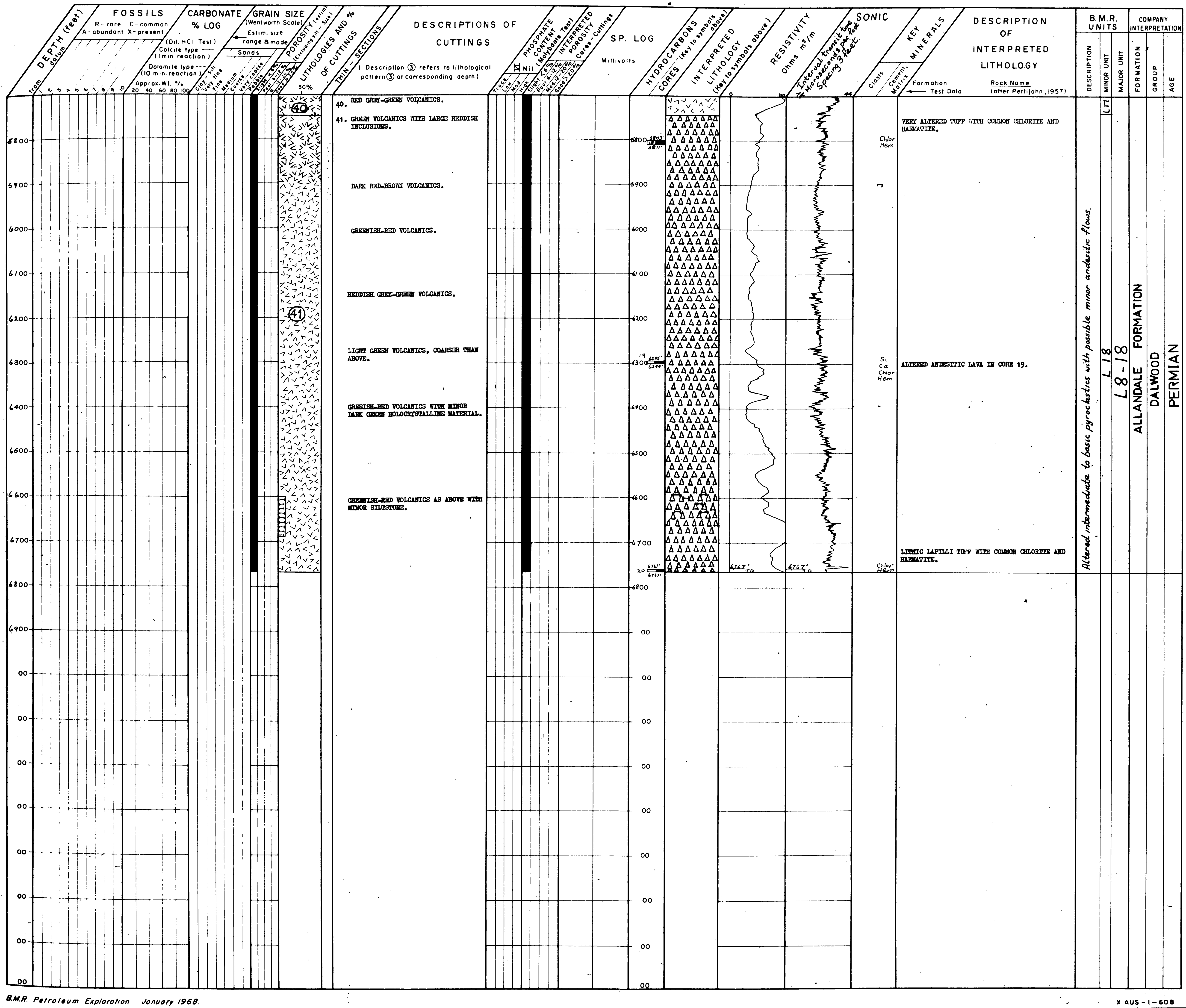
ALLANDALE FORMATION

DALWOOD

PERMIAN

B.M.R. Petroleum Exploration January 1968.

X AUS-1-60B


DEPTH (feet) from datum
FOSSILS
R - rare C - common
A - abundant X - present
CARBONATE % LOG
(Dil. HCl Test)
Calcite type
(1 min reaction)
Dolomite type
(10 min reaction)
Approx. Wt. %
GRAIN SIZE
(Wentworth Scale)
Estim. size range & mode
Sands
Clay, Silt, Very fine, Fine, Medium, Coarse, Very coarse, Pebble
POROSITY (estim) (Excluding silt - Size)
LITHOLOGIES AND % OF CUTTINGS
50%
THIN - SECTIONS
DESCRIPTIONS OF CUTTINGS
(Description ③ refers to lithological pattern ③ at corresponding depth)
PHOSPHATE CONTENT (Molybdate Test)
Nil, Trace, Low, Mod, High
INTERPRETED POROSITY Cores - Cuttings
Slight, Poor, Mod, Good
S.P. LOG
Millivolts
HYDROCARBONS CORES (Key to symbols above)
INTERPRETED LITHOLOGY (Key to symbols above)
RESISTIVITY Ohms m²/m
SONIC
Interval transit time in Microseconds per foot. Spacing 3 feet.
KEY MINERALS
Clasts
Cement, Matrix
DESCRIPTION OF INTERPRETED LITHOLOGY
Formation ← Test Data
Rock Name (after Pettijohn, 1957)
B.M.R. UNITS
DESCRIPTION
MINOR UNIT
MAJOR UNIT
COMPANY INTERPRETATION
FORMATION
GROUP
AGE
5800
5900
6000
6100
6200
6300
6400
6500
6600
6700
6800
6900
40
41
40. RED GREY-GREEN VOLCANICS.
41. GREEN VOLCANICS WITH LARGE REDDISH INCLUSIONS.
DARK RED-BROWN VOLCANICS.
GREENISH-RED VOLCANICS.
REDDISH GREY-GREEN VOLCANICS.
LIGHT GREEN VOLCANICS, COARSER THAN ABOVE.
GREEISH-RED VOLCANICS WITH MINOR DARK GREEN HOLOCRYSTALLINE MATERIAL.
GREENISH-RED VOLCANICS AS ABOVE WITH MINOR SILTSTONE.
5803'
5811'
19
6296'
6299'
20
6761'
6767'
6767' TD
6767' TD
Chlor Hem
Si Ca Chlor Hem
Chlor Hem
VERY ALTERED TUFF WITH COMMON CHLORITE AND HAEMATITE.
ALTERED ANDESITIC LAVA IN CORE 19.
LITHIC LAPILLI TUFF WITH COMMON CHLORITE AND HAEMATITE.
Altered intermediate to basic pyroclastics with possible minor andesitic flows.
L17
L18
L8-18
ALLANDALE FORMATION
DALWOOD
PERMIAN

WELL NAME, No.: LODER (AOG) No 1
OPERATING Co.: A.O.G.
WELL LOCATION
Lat. 32° 38' 07"S. Long.: 151° 08' 00"E.
Basin: SYDNEY
State: N.S.W.
Tenement No P.E.L. 9
1:250,000 Sheet No. SI 56 1

ELEVATION (A.S.L.)
Ground Level 338·40 ft.
K.B. Datum 355·15 ft

SAMPLE STORAGE
B.M.R., Canberra

PETROGRAPHIC CORE LOG
LODER (AOG) No1

Geology by E. NICHOLAS, L.E. KURYLOWICZ.

Plate 2A

Legend

- Cross bedding
- Organically reworked
- Burrow structure
- Bedded > 5cm
- Bedded 0·1 – 0·5cm
- Bedded < 0·1 cm
- Interval 6540'6" – 6541'6": Core not recovered
- Position of lost core not known

Porosity (estimated)	
S – Slight	< 6%
P – Poor	6–12%
M – Medium	12–12%
G – Good	> 20%

Abundance (estimated)	
R – Rare	< 1%
C – Common	1–3%
A – Abundant	> 3%

Siderite; Dawsonite; Silica; Volc. agglom. breccia lapilli tuff; Volc. Basic; Tuff Fine tuff; Volc. Undiff.; Volc. Interm.; Breccia to conglomerate; Quartz sand, sandstone; Siltstone; Claystone; Limestone*; Dolomite*; Coal; Shale and mudstone; Calcirudite*; Calcarenite*; Calcilutite*

* Symbols used to designate carbonate minerals (Calcite, Dolomite etc) in the "Essential Components" column

CORRELATION

Age: PERMIAN
Group: MAITLAND GROUP
Formation: BRANXTON SUB-GROUP
B.M.R. Units: L 1-3 (L1)

GENERALIZED DESCRIPTION

Core No (Recovery)	Footages	Description	Colour
1 (10')	538'–548'	**Sandstone.** Very fine to fine grained. Disturbed, churned bedding.	Medium grey
3 (3'6")	845'–848'6"; 849'	**Sandstone** Very fine to fine-grained. Churned disrupted bedding. Some sub-horizontal dark grey laminae.	Medium grey
4 (6'0")	1109'–1115'; 1119'	**Sandstone.** Medium grained. Well bedded in parts. Some irregular horizontal carbonaceous silty laminae are present near the bottom of the section. Some pebbly layers are present	Light grey
5 (11'7")	1395'–1406'7"; 1407'	**Sandstone** Medium grained. Some high angle cross bedding at 1399'. Pebbly layers.	Light grey

DETAILED DESCRIPTION

Depth of sample sectioned, analyzed	Specific rock name (After Pettijohn 1957)	Porosity / Permeability
540'–40½"	Protoquartzite	
(7)		NIL NIL
847'–47'7"	Protoquartzite	(9) NIL NIL
1109'–09'4"	Protoquartzite	
(10)		NIL NIL
1395'–95'4"	Protoquartzite	
(12)		NIL NIL

Accessory minerals (Estim R-C-A or Measured % Total Rock)

Depth	Total "Dark"	1 Pyrite	2 Zircon	3 Tourmaline	4 Biotite	5	6	7	Light 1 Muscovite	2 Sericite	3 Plagioclase	4 Microcline	5
540'		R	C	R	R	C			C	C			
847'			C			A				A	R		
1109'		C	R		R	C			R		R	R	
1395'		R	R			R			R		R		

NOTES

(provenance, environment of deposition, diagenesis, palaeontology etc)

540': Sedimentary and possibly subsidiary granitic provenance. Deposition in quiet shallow marine environment. Sediment churned by burrowing organisms. One brachiopod seen. The sediment is well cemented with siderite and dawsonite

847': Sedimentary and possibly subsidiary granitic provenance. Deposition in quiet shallow marine environment. Worm burrows and bivalves. Dawsonite, siderite and silica cement.

1109': Sedimentary and possibly subsidiary granitic provenance. Deposition in quiet shallow marine environment. Poorly preserved bivalves and sub-horizontal worm burrows, (some filled with coarser sand.) Siderite and dawsonite cement, and minor silica.

1395': Sedimentary and possibly subsidiary granitic provenance. Deposition in mainly quiet shallow marine environment. Some sub-horizontal worm burrows and shell fragments. Well indurated with siderite dawsonite and silica cement.

CORRELATION: AGE; COMPANY INTERPRETN: GROUP, FORMN, BMR UNITS

GENERALIZED DESCRIPTION: CORE Nos RECOVERY FOOTAGES; LITHOLOGY; DESCRIPTION (GENERALIZED ROCK NAME); COLOUR (Rock Colour Chart GSA 1948); SEDIMENTARY STRUCTURE (see legend); DIP & TECTONIC STRUCTURE

DETAILED DESCRIPTION: DEPTH OF SAMPLE SECTIONED, ANALYZED; SPECIFIC ROCK NAME (After Pettijohn 1957); POROSITY (% where measured); PERMEABILITY (Millidarcys); ROUNDNESS; SORTING; GRAIN-SIZE (Wentworth Scale, Estm size Range & Mode); SANDS; THIN-SECTION ANALYSIS (% OF ESSENTIAL COMPONENTS; Matrix and/or Cement Estim % of Total Rock); ACCESSORY MINERALS (Estm % or Accurately Measured % of Total Rock); MATURITY INDEX; NOTES (provenance, environment of deposition, diagenesis, palaeontology etc.)

AGE	GROUP	FORMN	BMR UNITS	CORE / FOOTAGES	LITHOLOGY	DESCRIPTION	COLOUR	SED. STRUCTURE	DIP & TECTONIC STRUCTURE	DEPTH OF SAMPLE	SPECIFIC ROCK NAME	NOTES
PERMIAN	MAITLAND	BRANXTON SUB-GROUP	L1-3 L3	1852'								
				6 (10')		**Sandstone.** Bedding of variable thickness in top 11". Churned, disturbed bedding in remaining sequence. Some of the pebbles possibly erratics.	Light grey				Protoquartzite	Sedimentary, and possibly subsidiary granitic with minor volcanic provenance. Deposition in quiet marine–brackish environment. Vertical and sub-vertical burrows. Shell fragments in bedded sequence. Dawsonite, siderite and silica cement.
				1862'						1858'-58'4"		
	GRETA		L4 L4	2355' 7 (3') 2358'		**Conglomerate** Mainly quartz, chert and siltstone pebbles, with some volcanic and metamorphic. Sub to well rounded. Some steep cross-bedding.	Mottled yellow and Light grey			2355'-55'4"	Quartzose lithic conglomerate	Sedimentary with subsidiary volcanic and minor metamorphic provenance. Deposition in high energy fluvial environment. Well compacted, with siderite cement. Minor dawsonite and clay-silt.
				2670'		**Sandstone** Disturbed bedding. Thin discontinuous dark sub-horizontal laminae are present.	Med. Dark grey				Protoquartzite Abundant chert and other sedimentary lithics	Sedimentary and possibly subsidiary granitic with minor metamorphic and volcanic. Deposition in quiet brackish environment. Sub-vertical worm burrows. Silica cement. Minor dawsonite.
			L5-6 L5	8 (10')								
				2680'						2676'-77'8"		
PERMIAN	DALWOOD	FARLEY	L5-6 L6	2973' 9 (10') 2983'		**Sandstone** Churned, disturbed bedding with discontinuous sub-horizontal silty lenses. Pebble erratics?	Med. light grey			2976'-75'4"	Siderite feldspathic sandstone	Sedimentary with subsidiary granitic and volcanic provenance. Deposition in quiet marine–brackish environment. Carbonaceous plant fragments 2976'. Closed and partly silicified bivalve 2981'. Sub vertical and sub-horizontal worm burrows.
				3220'		**Siltstone** Poorly bedded. Thin discontinuous laminae.	Med. Dark Grey			3222'-21'4"	Sandy Siltstone.	Sedimentary, granitic and volcanic provenance. Deposition in a near-shore possibly tidal-flat environment. Shell fragments and sub-horizontal burrows.
	RUTHERFORD		L7 L7	10 (8') 3229'								

BINDING MARGIN

Age	Group	Formation	B.M.R. Units	Core No. & Footages	Description (Generalized Rock Name)	Colour	Sedimentary Structure	Depth of Sample Sectioned, Analyzed	Specific Rock Name (After Pettijohn 1957)	Porosity	Permeability (Millidarcys)	Accessory Minerals	Notes (provenance, environment of deposition, diagenesis, palaeontology etc.)
PERMIAN	DALWOOD GROUP	RUTHERFORD	L7	11 (10') 3540'–3650'	**Siltstone** Churned, disrupted bedding. Thin discontinuous dark laminae. Sub parallel clay lenses	Dark grey	ϟϟϟ		Fine Siltstone	10	NIL NIL		Sedimentary, granitic and volcanic provenance. Deposition in quiet, near-shore possibly tidal-flat environment. Poorly preserved bivalves and calcitic (fossil?) fragments observed.
								3549'4"-8"	Fine siltstone			CR C C	
		RUTHERFORD	L7	12 (10') 3815'–3825'	**Siltstone.** Horizontal bedding to 3817'. Poorly bedded elsewhere. Thin discontinuous dark laminae. Pebble erratics.	Dark grey	═		Fine Siltstone	9	NIL NIL		Sedimentary, granitic and volcanic provenance. Deposition in quiet near-shore possibly tidal-flat environment. A small bivalve and shell fragments observed.
								3821'-21'4"	Fine siltstone				
		ALLANDALE	L8	13 (10') 3940'–3950'	**Volcanic lava.** Coarsley crystalline with flow bands 10cm wide	Grey green			Altered zeolitic basalt		NIL NIL		Basaltic lava flow. Altered felspar phenocrysts. Fractures filled with calcite. Pyrite associated with zeolite. Zeolite filled vugs.
								3946'5"-9"	Altered zeolitic basalt				
		ALLANDALE	L8-13 / L9	14 (10') 4500'–4510'	**Amygdaloidal agglomerate** Minor flow banding.	Grey green		4500'5"-07'6"	Andesitic agglomerate.	19	NIL NIL		Volcanic provenance. A little basaltic material but rock mainly composed of fragments of altered andesite. Large vugs filled with green alteration products.
			L10	15 (18") 4675'–4677'	**Conglomerate.** Poorly bedded.			4675'	Volcanic conglomerate.	3	NIL NIL		Volcanic and sedimentary Provenance. Pebbles of chert, and altered andesite and basalt. One possibly metaquartzite pebble seen in thin section.

CORRELATION | GENERALIZED DESCRIPTION | DETAILED DESCRIPTION — 2D

AGE: PERMIAN
GROUP: DALWOOD GROUP
FORM'N: ALLANDALE
B.M.R. UNITS: L8-18 / L14 / L11 / L18 / L18 / L18

CORE No RECOVERY FOOTAGES	LITHOLOGY	DESCRIPTION (GENERALIZED ROCK NAME)	COLOUR (Rock Colour Chart GSA 1963)	SEDIMENTARY STRUCTURE (Symbols)	DIP & TECTONIC STRUCTURE	DEPTH OF SAMPLE SECTIONED, ANALYZED	SPECIFIC ROCK NAME (After Pettijohn 1957)	POROSITY % where measured	PERMEABILITY Millidarcys	ROUNDNESS	SORTING	GRAIN-SIZE (Wentworth Scale) Estim size Range & Mode — SANDS	% OF ESSENTIAL COMPONENTS (cross hatched if material clearly present as cement and/or matrix; porosity shown as blank)	Matrix and/or Cement Estim % of Total Rock (Clay-undiff; Kaolin Gp)	ACCESSORY MINERALS Estim R-C-A or Measured % Total Rock ("Dark Minerals"; "Light Mins")	MATURITY INDEX	NOTES (provenance, environment of deposition, diagenesis, palaeontology, etc)
4846'																	
16 (4')		Tuff. Poorly bedded.	Dark grey green			9	Lapilli tuff (Trachytic)	9	NIL	NIL							Coarse pyroclastic mainly trachytic. Very fine grained sedimentary lithics. Vugs are common, filled with chlorite or chalcedony.
4860'																	
5285'																	
17 (2'11")		Finely crystalline volcanic. Contains fractures filled with haematite or zeolite.	Pale green				Altered andesite.	21	NIL	NIL							Andesitic lava flow. Fine grained devitrified matrix. Plagioclase phenocrysts altered to carbonate. Pyroxene altered to epidote.
5288'11"						5287'8"-11"											
5289'																	
5803'																	
18 (7'5")		Tuff. No bedding	Mottled pink and dark green			5804'5"-9"	Tuff. Lapilli tuff in parts, but mainly finer, with only the larger fragments > 4mm	6	NIL	NIL							Interm-basic pyroclastic. Common chlorite and haematite. Altered feldspar phenocrysts.
5810'6"																	
5811'																	
6294'																	
19		Lapilli tuff at the top. Finely crystalline volcanic elsewhere with haematite filled fractures.	Olive green				Altered andesite similar to 17.										Interm-basic pyroclastic. Very altered feldspar phenocrysts in andesitic lava flow. Clear quartz grains (secondary) Common chlorite and haematite. Common vugs, filled with concentrically arranged silica and carbonate.
6298'6"						6297'7"-6298'-6"		5	NIL	NIL							
6299'																	
6761'																	
20 (5')		Fractured tuff. Haematite in fractures. No bedding.	Red and olive green			6761'-67'	Altered intermediate basic lithic lapilli tuff.	7	2	57							Volcanic provenance. great mixture of volcanic material. Common chlorite and haematite.
6766'																	

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