COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT BUREAU OF MINERAL RESOURCES, GEOLOGY AND GEOPHYSICS

Petroleum Search Subsidy Acts
PUBLICATION No. 75

SUMMARY OF DATA AND RESULTS BONAPARTE GULF BASIN WESTERN AUSTRALIA

Bonaparte No. 1 and No. 2 Wells

OF

ALLIANCE OIL DEVELOPMENT AUSTRALIA NO LIABILITY

Issued under the Authority of the Hon. David Fairbairn

Minister for National Development

1966

COMMONWEALTH OF AUSTRALIA

DEPARTMENT OF NATIONAL DEVELOPMENT

MINISTER: THE HON. DAVID FAIRBAIRN, D.F.C., M.P.

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Canberra, A.C.T.

FOREWORD

Under the Petroleum Search Subsidy Act 1959-1964, agreements relating to subsidized operations provide that the information obtained may be published by the Commonwealth Government six months after the completion of field work.

The growth of the exploration effort has greatly increased the number of subsidized projects and this increase has led to delays in publishing the results of operations.

The detailed results of subsidized operations may be examined at the office of the Bureau of Mineral Resources in Canberra (after the agreed period), and copies of the reports may be purchased.

In order to make the main results of operations available early, short summaries are being prepared for publication. These will be grouped by area and date of completion as far as practicable. Drilling projects and geophysical projects will be grouped separately. In due course, full reports will be published concerning those operations which have produced the more important new data.

This Publication contains summaries of data and results of two drilling operations undertaken in the Bonaparte Gulf Basin, Western Australia: Bonaparte No. 1, and Bonaparte No. 2. The information has been abstracted by the Petroleum Exploration Branch of the Bureau of Mineral Resources from well completion reports furnished by Alliance Oil Development Australia No Liability.

J. M. RAYNER DIRECTOR

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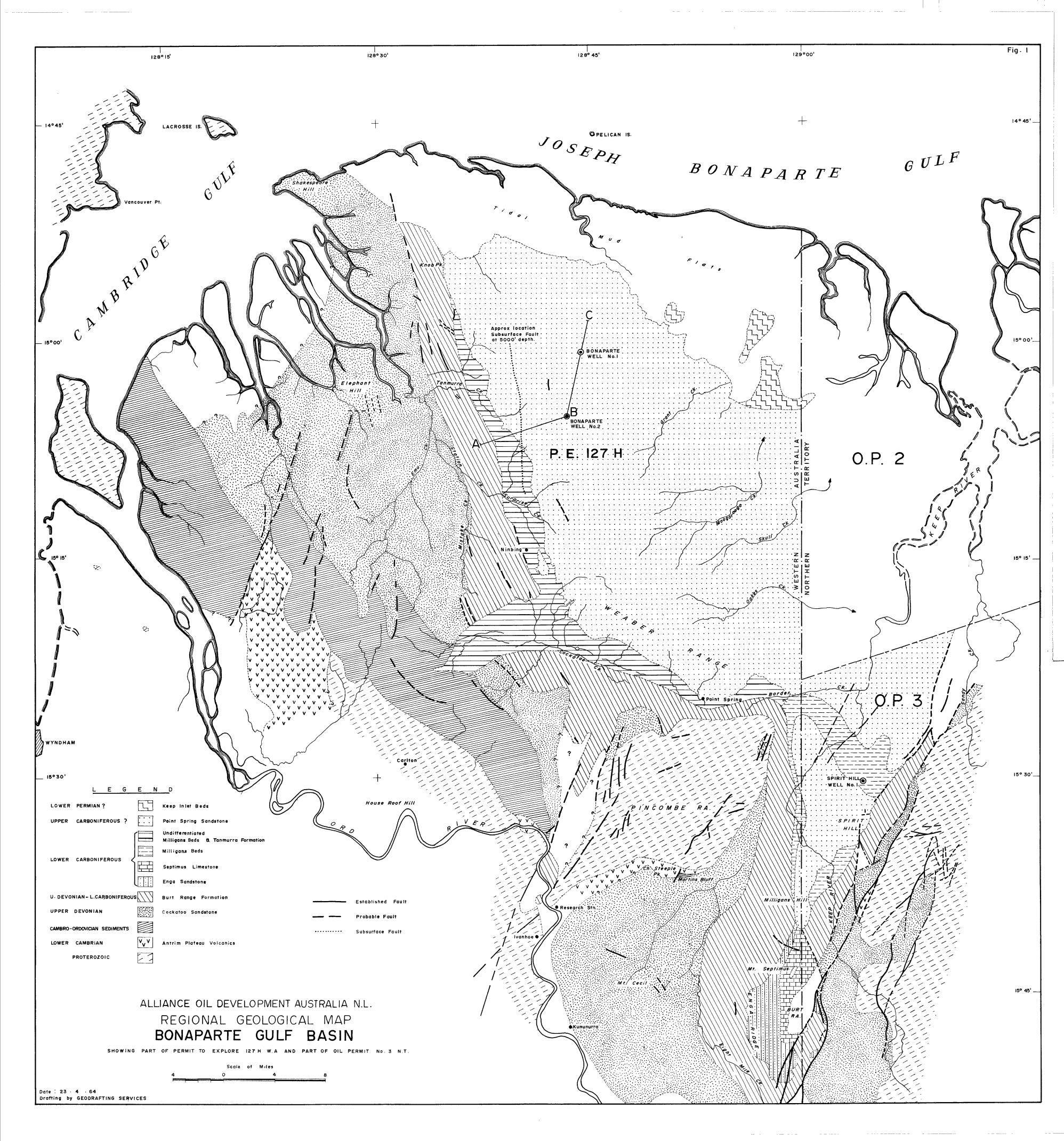
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BONAPARTE NO. 1

of

ALLIANCE OIL DEVELOPMENT AUSTRALIA NO LIABILITY

SUMMARY OF DATA AND RESULTS



BONA PARTE NO. 1

SUMMARY OF DATA AND RESULTS*

SUMMARY

Bonaparte No. 1 Well, located approximately 52 miles north-east of Wyndham, in the Bonaparte Gulf Basin of Western Australia, was drilled by Reading and Bates (Australia) Pty Ltd for Alliance Oil Development Australia No Liability to total depth of 10,530 feet. Drilling commenced on 18th July, 1963, was suspended at 10,283 feet on 19th December, 1963, resumed on 25th April, 1964, and was completed on 4th June, 1964. A full programme of logging, coring, and testing was undertaken.

The well penetrated the Upper Carboniferous Point Spring Sandstone from surface to 638 feet; the Lower Carboniferous Tanmurra Formation to 1630 feet, and Milligans Beds to 7480 feet; the Lower Carboniferous to Upper Devonian Burt Range Formation Equivalent to 9492 feet; and the Upper Devonian Cockatoo Sandstone Equivalent to 10,530 feet, total depth. An angular unconformity occurred at the base of the Milligans Beds.

Of the twenty drillstem tests conducted during the drilling operation, three yielded fresh water from the Tanmurra Formation, and one yielded gas-cut salt water from the interval 5627 to 5696 feet in the Milligans Beds. Four tests were misruns, and twelve obtained no recovery other than drilling fluid. The well was plugged and abandoned as a dry hole on 6th June, 1964.

The stratigraphic drilling operation at Bonaparte No. 1 Well was subsidized under the Petroleum Search Subsidy Act 1959-1961, from surface to total depth.

^{*} Abstracted from: Well Completion Report, Bonaparte Well No. 1, by M.C. Le Blanc, Alliance Oil Development Australia No Liability, July, 1964.

WELL HISTORY

General Data

Well name and number:

Bonaparte No. 1

Location:

15⁰01' 00" S. 128⁰44' 30" E. Latitude

Longitude

Name and address of

Alliance Oil Development Australia N.L.,

Tenement Holder:

100 Collins Street,

Melbourne, Victoria

Details of Petroleum

Permit to Explore 127H,

Tenement:

Western Australia (approximately 13,800 square miles)

Total Depth:

10,530 feet

Date drilling commenced:

18th July, 1963

Date drilling suspended:

19th December, 1963, at 10,283 feet with fish in hole

Date drilling resumed:

25th April, 1964

Date drilling completed:

4th June, 1964

Date well abandoned:

6th June, 1964

Date rig released:

6th June, 1964

Elevation (ground):

339 feet

Elevation (K.B.):

355,3 feet (datum for depths)

Status:

Plugged and abandoned as a dry hole

Cost:

£427,000 approx.

Drilling Data

Drilling Plant:

National

Make: Type:

75

Hole sizes and depths:

20" to 29 feet 17 1/2" to 560 feet

12 1/4" to 4964 feet

8 3/4" to 10530 feet (T.D.)

Casing details:

Size (in.):

Grade:

18 1/2

13 3/8

9 5/8

Weight (lb./ft):

48 H.40 36

Setting depth (ft):

29

510.9

J.55 4911

Logging and Testing

Ditch Cuttings:

Interval:

Ten feet from surface to total depth.

Interval reduced to five feet during coring, and in

zones of special interest.

Coring:

Thirty-four cores, with a total length of 329 feet and a recovery of 263 feet 7 inches (82.6%), were cut. The core barrel was a 30-foot, 6 7/8" OD., C.D.T. core barrel, and the bits used were "Truco Tridia" and "Mindrill" diamond coreheads and "Hughes" con-

ventional drag-type and cone-type coreheads.

Sidewall Cores:

Although forty-six shots were fired, only twelve samples were recovered, of which five were inter-

mixed filter cake and rock fragments.

Halliburton equipment was used.

Electric and other logging (Halliburton):

Induction-Electric Log:

100-10278 feet (5 runs)

Dip Log:

4904~ 9949 feet (1 run)

Contact Caliper Log:

510-10280 feet (4 runs)

Acoustic Velocity Log:

60- 556 feet (1 run)

Acoustic Velocity Log with Gamma Ray:

510- 9944 feet (2 runs)

Velocity Survey:

A velocity survey (21 shots) was run from 5100 to 9400 feet by Petty Geophysical Engineering Company.

Drilling Rate and Gas Log:

Continuous drilling rate and gas plots were recorded during drilling,

Formation Testing:

Twenty Halliburton formation tests were carried out during the drilling operation.

Sixteen tests were conducted in open hole, concurrently with drilling operations; four were misruns because of packer seat failures. An additional four tests were conducted in open hole after the well had reached total depth; one was a misrun because of packer failure.

Detailed results of the formation tests are given in Appendix 6 to the well completion report.

Copies are available for inspection at the Bureau of Mineral Resources, Canberra.

Deviation Survey:

Seventy-one readings with a Totoo instrument were taken during drilling. The maximum hole deviation of 5 1/4° was recorded at 9063 feet. The final reading at 10.508 feet was 1/2.

Temperature Survey:

Bottom-hole temperatures were taken at 4964, 7960 and 9952 feet; the readings were 137 F, 188 F, and 216 F. respectively.

GEOLOGY

General

Structurally, the Bonaparte Gulf Basin is bounded on the east by the Sturt Block and to the south-west by the Kimberley Block, both of Precambrian age. The seaward extent of the Basin is at present unknown but it can be inferred to extend as far northwards as the off-shore area to the west of Bathurst Island, where an aeromagnetic survey conducted in 1963 indicated a gradual thickening of the sedimentary section.

The land area comprising the southern portion of the Basin is divided into two embayments by a Precambrian basement ridge, known as the Pincombe Range, which trends north-east: the Carlton Embayment lies to the north and north-west of the Pincombe Range, and the Burt Range Embayment to the south and east. Structurally, the Basin is believed to have originated through subsidence of the north-eastern end of the Kimberley Block, and downsinking by step faulting (with downthrow to the west) of an associated mobile zone between the Kimberley and Sturt Blocks (Drummond, 1963).

Within the Carlton Embayment, Palaeozoic strata approximately 9500 feet thick, are exposed at the surface. The outcropping sediments are of Permian (?), Carboniferous, Devonian, Ordovician, and Cambrian age. Seismic and gravity data indicate that a much thicker section, approximately 12,000 to 15,000 feet thick, is present in the deeper part of the Embayment. Basement consists of relatively unmetamorphosed Proterozoic sediments; Lower Cambrian volcanics, which occur sporadically around the southern margin of the Embayment, locally may constitute effective basement.

In general, surface expression of structure within the Carlton Embayment is confined to the southern and western margins of the Embayment where, during early Carbon-iferous time, Cambrian, Ordovician, and Devonian to Lower Carboniferous sediments were strike-faulted and tilted 20 to 30 degrees to the north-east (Veevers et al., 1964). The development of the deeper part of the Embayment, the approximate on-shore limits of which are defined by the area of outcrop of Point Spring Sandstone as shown on Figure 1, probably was accelerated in early Carboniferous time through further downwarping, with associated block-faulting, of a portion of the Precambrian Kimberley Block. A thick sequence of Lower Carboniferous and early Upper Carboniferous sediments, in excess of 7400 feet, was subsequently deposited in the deeper part of the Embayment; these sediments unconformably overlap the older sediments of the upthrown block to the west.

Over the deeper part of the Embayment there is little surface evidence of structure and the strata for the most part dip gently basinwards. However, the data obtained from

the gravity survey conducted in 1961, and from subsequent seismic surveys, indicate that closed structures are present in the subsurface. Since significant folding is not known to have occurred in the Embayment, it is considered that these features represent draped structures resulting from differential compaction of sediments over and around the upthrown portions of tilted fault blocks, or above topographic "highs" on the basement floor.

Abundant cap rock, source, and reservoir beds are present within the outcropping Palaeozoic sequence. Although the nature of the sediments of the deeper part of the Embayment is but little known at present, the results of the Bonaparte No. 1 Well have shown that a similar favourable lithological combination can be expected throughout most of the Embayment.

Stratigraphy

General:

Bonaparte No. 1 Well spudded in the Upper Carboniferous Point Spring Sandstone, and then penetrated the Lower Carboniferous Tanmurra Formation, and Milligans Beds to an angular unconformity at the base of the latter. Below the unconformity the well entered the Lower Carboniferous to Upper Devonian Burt Range Formation Equivalent, followed by the Upper Devonian Cockatoo Sandstone Equivalent in which it bottomed at 10,530 feet. The stratigraphic sequence encountered in Bonaparte No. 1 is shown in the Table below:

Age	Formation	Depth Intervals (feet)	Thickness (feet)
Upper Carboniferous	Point Spring Sandstone	16 - 638	622+
Lower Carboniferous	Tanmurra Formation	638 - 1630	992
Lower Carboniferous	Milligans Beds	1630 - 7480	5850
	Angular Unconformity		
Lower Carboniferous to Upper Devonian	Burt Range Formation Equivalent	7480 - 9492	2012
Upper Devonian	Cockatoo Sandstone Equivalent	9492 -10530(T.D.)	1038+

Detailed:

Point Spring Sandstone (Upper Carboniferous, Namurian): Surface to 638 feet (622 feet+)

The upper part consists of colourless to white, medium to coarse-grained, porous, poorly consolidated, quartz sandstone. The lower part differs in that the quartz grains are frosted, and in the presence of kaolin cement.

Tanmurra Formation (Lower Carboniferous, Visean): 638 to 1630 feet (992 feet)

The top 86 feet is a buff to medium grey, sandy and silty, medium-grained <u>colite</u> grading downwards into coarse-grained <u>calcirudite</u>, and then into fine-grained calcarenite.

The middle unit of the formation (840 feet) consists mainly of white to medium grey, fine to medium-grained, angular, porous, quartz <u>sandstone</u> with interbeds of finely crystalline, silty to sandy <u>limestone</u> and recrystallized <u>calcarenite</u> near the top. Lower down, interbeds of dolomite are common and, in several places, the matrix of the sandstone is 40 percent dolomitic.

The bottom 66 feet consist of a light brown, fine-grained <u>calcarenite</u> which is partly pelletoidal.

Milligans Beds (Lower Carboniferous, Visean to Tournaisian): 1630 to 7480 feet (5850 feet)

The formation consists predominantly of medium grey, marine shale with, from 3800 feet, sandstone and siltstone interbeds. Concretionary and bedded ironstone is common in the upper part of the formation. On the basis of gross lithological characteristics, the formation has been subdivided into four units:

1630 to 3800 feet:

This unit consists essentially of medium grey, non-silty to moderately silty, fossiliferous, sub-fissile to fissile, marine shale. Numerous crinoid stem-fragments are present between 1800 to 2100 feet; within this same interval several beds of fine to medium-grained, sandy to silty, bioclastic and fragmental limestone are present.

The uppermost 120 feet of the unit, which is very silty and includes interbedded <u>sandstone</u> and <u>siltstone</u>, may be a zone of transition to the overlying Tanmurra Formation.

A few beds of medium grey, sandy and argillaceous <u>sandstone</u> are present in the upper part of the unit; concretionary and bedded <u>ironstone</u> is common throughout.

3800 to 6453 feet:

This unit consists of shale with approximately 11 percent of interbedded quartz sandstone and includes scattered thin beds of siltstone. The shale is medium to medium dark grey, rarely brownish and greenish-grey, generally slightly silty and occasionally sandy, sub-fissile to chunky.

The sandstone consists of white to buff, very fine-grained, subround to subangular, moderately well-sorted to poorly sorted quartz which is cemented with calcite and/or silica. Many of the sandstone beds show fair to good intergranular porosity; others are tight as a result of high silt content and/or of secondary silicification.

A few interbeds of grey to brown, argillaceous, slightly calcareous siltstone are scattered throughout the unit.

6453 to 7100 feet:

The unit consists of silty shale with approximately 24 percent of interbedded, quartz sandstone and a lesser amount of argillaceous siltstone. The shale is medium grey, moderately silty and in part sandy, platy to blocky.

The sandstone consists of light grey to buff, very fine-grained, angular to subangular, poorly sorted quartz which is well cemented, most commonly with silica. The sandstone is generally very silty and tight although some poor intergranular and capillary porosity is present in several of the beds.

The siltstone is grey, siliceous and argillaceous.

7100 to 7480 feet:

This unit consists entirely of medium light to medium dark grey, slightly silty, sub-fissile to blocky shale, which becomes bituminous near the base of the unit.

These basal beds rest with angular unconformity upon the Burt Range Formation Equivalent.

Burt Range Formation Equivalent (Lower Carboniferous to Upper Devonian): 7480 to 9492 feet (2012 feet)

The formation has been divided on lithological and electrical log characteristics into six units as follows:

7480 to 7865 feet:

This unit, the "Upper Shale Unit", consists of medium grey, platy to blocky shale, which is in part slightly silty and occasionally waxy to bituminous. The induction-electric and contact caliper logs suggest that some siltstone is present near the top of the unit, but none was observed in the cuttings. Several thin beds of very fine-grained quartz sandstone are present near the middle of the unit.

7865 to 8195 feet:

This unit, the "First Shale and Siltstone Unit", consists of <u>shale</u> with interbeds of <u>siltstone</u>, which become thicker and more common towards the base of the unit.

In the upper part the shale is medium grey, moderately to very silty, moderately micaceous, slightly calcareous, and platy to blocky. Towards the base of the unit it becomes less silty and micaceous, is often bituminous, and for the most part is non-calcareous.

The siltstone is light to medium grey, commonly calcareous and in part micaceous; towards the base of the unit several beds are moderately sandy and argillaceous.

8195 to 8300 feet:

This unit, the "First Sandstone Unit", consists of white to light grey (in part brownish-grey), fine-grained, angular to subangular, quartzose sandstone with some shale grains. The sandstone is moderately to very silty, very calcareous, and is cemented with carbonate cement which becomes more

abundant towards the base, where several thin beds of sandy and silty <u>limestone</u> are present. A few thin beds of siltstone also occur near the base of the unit.

8300 to 9035 feet:

This unit, the "Second Shale and Siltstone Unit", consists mainly of interbedded shale and argillaceous siltstone, but also includes a few beds of silty sandstone.

In the upper part the shales are light to dark grey, silty and in part micaceous, commonly slightly calcareous, occasionally bituminous, subfissile to blocky; in the lower part they become greenish and brownish-grey, blocky, and for the most part are moderately silty.

The siltstones are light to medium grey and greenish-grey, calcareous, and moderately argillaceous. They become very finely sandy and siliceous towards the base of the unit. Several beds of very fine-grained, moderately to very silty, calcareous, quartzose sandstone are also present.

9035 to 9260 feet:

This unit, the "Second Sandstone Unit", consists of interbedded and gradational silty sandstone and lesser sandy siltstone.

The sandstone is light grey (in part greyish-brown) very fine-grained, calcareous, moderately to very silty, and is generally siliceous; it consists of angular to subangular quartz and rare shale grains which are cemented with abundant carbonate cement. The siltstone is grey, green, and brownish-grey, siliceous, calcareous, and is generally very finely sandy. Several interbeds of grey, green, and black, silty shale are also present.

9260 to 9492 feet:

This unit, the "Basal Variegated Shale Unit", consists of variegated (green with lesser amounts of black, brown and rust), micaceous, moderately silty shale. The sequence includes a few thin beds and lenses of siltstone and of silty, very fine-grained, calcareous, quartzose sandstone.

Cockatoo Sandstone Equivalent (Upper Devonian): 9492 to 10,530 feet (1038 feet+)

The sequence present in the interval 9492 feet to total depth has been correlated with the Cockatoo Sandstone on the basis of a marked change in the lithological, electrical, and velocity characteristics of this unit from those of the overlying sediments.

The sequence consists predominantly of interbedded <u>sandstone</u>, <u>siltstone</u>, and <u>shale</u>. The sandstones differ from those of the Burt Range Formation Equivalent in that they are generally of a coarser grain size and are most commonly non-calcareous. The shales, however, are very similar to those of the "Basal Variegated Shale Unit" of the Burt Range Formation Equivalent.

The sandstones consist of white to light grey, very fine-grained to fine-grained, angular to subangular quartz, cemented with a powdery siliceous cement. They are commonly very siliceous and are generally silty.

In the upper part of the formation the shales are variegated in colour, generally moderately silty, and are commonly micaceous. Towards the base of the formation, medium dark grey, micaceous and silty shale predominates although some variegated shale is also present.

The siltstones are generally light to medium grey, slightly calcareous and are commonly siliceous. In the interval 10,280 feet to 10,320 feet they become medium grey to olive-grey, very calcareous, and in part grade to silty, microcrystalline limestone.

Structure

The well was located on what was thought to be a small structure identified by seismic survey, having a closure of about 125 feet at a depth of 5000 feet. Further seismic work during the drilling of Bonaparte No. 1 indicated that, in fact, the well was located low down on the north-east flank of a closed structure, five miles north of its culmination. The continuous dipmeter survey indicated dips generally between 4 and 6 north above 7472 feet; below 7520 feet the direction changed abruptly to east-south-east and then, at 8524 feet, to south or south-east.

The dipmeter data have been interpreted as indicating that an angular unconformity is present within the interval 7472 to 7520 feet, where gently dipping Lower Carboniferous strata with a northerly dip component overlie Burt Range and older sediments which have been block-faulted and tilted to the east-south-east.

Oil and Gas Indications and Potential

Neither fluorescence nor oil staining was observed in cuttings and cores. Trip gas was considered to have originated in the bituminous shales in the lower part of the Milligans Beds and the upper part of the Burt Range Formation Equivalent.

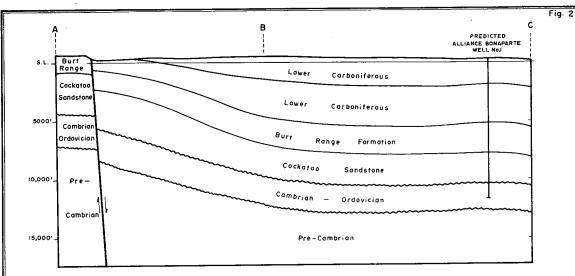
The Milligans Beds contain abundant source, cap, and reservoir beds. Cap rocks and source rocks are present in the older sediments but the sandstone horizons were mostly too well cemented or too silty to be suitable reservoir rocks.

Porosity and Permeability of Sediments Penetrated

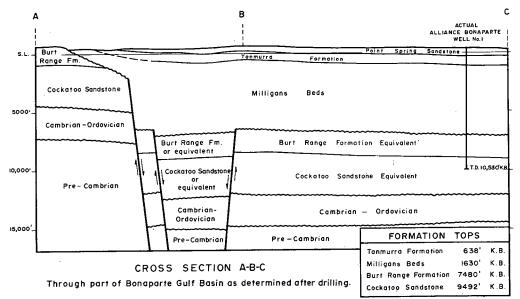
In general, the sandstones above 6453 feet have good porosity and permeability; those below this depth are most commonly tight.

The acoustic velocity log and core analyses indicate good porosity for the sandstone beds of the Point Spring Sandstone, and those of the Tanmurra Formation. The analysis of a core from the Point Spring Sandstone gave a porosity of 26 percent, a vertical permeability of 660 millidarcys and a horizontal permeability of 1200 millidarcys. Analyses of sandstone cores obtained from the Tanmurra Formation indicate a porosity of up to 30 percent but the sandstones have permeabilities of from 6 to 87 millidarcys only. The limestone members of the Tanmurra Formation are essentially tight.

No cores were obtained from any of the porous sandstones which are interbedded in the upper part of the Milligans Beds (1630 to 6453 feet) but the acoustic velocity



CROSS SECTION A-B-C
Through part of Bonaparte Gulf Basin as assumed before drilling.



ALLIANCE OIL DEVELOPMENT AUSTRALIA N.L. PERMIT TO EXPLORE 127H, WESTERN AUSTRALIA

ALLIANCE BONAPARTE WELL No.I

INTERPRETED GEOLOGICAL CROSS SECTIONS BEFORE DRILLING AND STRATIGRAPHIC DATA OBTAINED FROM DRILLING

HORIZONTAL SCALE OF MILES

HORIZONTAL SCALE OF MILES

Orafting by GEODRAFTING SERVICES, JULY 1964.

logs indicate that these sandstones have porosities which vary between 5 and 35 percent. The caliper log suggests that the permeability of the sandstone beds is also quite variable. The variation in porosity and permeability of the sandstone beds appears to be related to grain size and content of silt and argillaceous matrix rather than to secondary cementation.

Sandstone beds of the lower part of the Milligans Beds (6453 to 7480 feet), and the equivalents of the Burt Range Formation and Cockatoo Sandstone, have poor porosity and permeability. Porosity values of up to 7 percent were obtained from the acoustic velocity logs (using a matrix velocity of 19,000 feet/sec.) for sandstones within this interval; the actual porosity of the sandstones, however, is most probably in all cases considerably less than that determined from the acoustic velocity logs. Analyses of sandstones from depths of 6278 feet (Core No.22) and 6987 feet (Core No.25) indicate porosities of 4 percent and 1 percent respectively; the acoustic velocity log interpretation gives a porosity value of 7 percent for both of these sandstones. No sandstones were present in cores cut in the Burt Range Formation Equivalent. Core analysis data are available for only one sandstone in cores recovered from the Cockatoo Sandstone Equivalent; the porosity of this sandstone was found to be 3 percent.

Poor permeability is also indicated for the sandstone beds in the interval 6453 feet to 10,530 feet, where nine mechanically successful formation tests yielded no recovery other than drilling fluid.

Contribution to Geological Concepts resulting from Drilling

Data obtained from Bonaparte No. 1 Well support the seismic evidence which indicates that at least 15,000 feet of sediments are present within the deeper parts of the Bonaparte Gulf Basin.

The Upper Carboniferous sequence, which is thinner than had been anticipated, consists of 622 feet of Point Spring Sandstone at the well location.

The uppermost Lower Carboniferous sediments consist of 992 feet of sandstone and carbonate of the Tanmurra Formation. The formation was previously known only from scattered outcrops between Ninbing and Knob Peak to the west of the well.

The Tanmurra Formation is underlain by 5850 feet of the Lower Carboniferous Milligans Beds. Before drilling the well, the maximum known thickness of this formation was in the Burt Range Embayment where the Spirit Hill No. 1 Well penetrated 786 feet of shale correlated with the Milligans Beds.

In Bonaparte No. 1, the Milligans Beds consist of marine shales which exhibit the characteristics commonly attributed to source rocks and which also form an effective seal for the numerous porous sandstones which are included in the sequence. The petroleum prospects of the Bonaparte Gulf Basin are considerably enhanced by the presence of this thick sequence of Lower Carboniferous source, reservoir, and seal rocks.

The results of a dipmeter survey of the interval 4904 to 9949 feet in Bonaparte No. 1, show that an angular unconformity is present between the Burt Range Formation Equivalent and the overlying sediments. The angular unconformity results from the block-faulting and tilting of the Burt Range Formation and older sediments, which occurred in early Carboniferous time.

Six miles west of the well the Burt Range Formation crops out in carbonate facies. At the well, however, no carbonate is present, and the Burt Range Formation Equivalent is represented by a sequence of calcareous sandstone and siltstone with some shale.

On the western and southern margins of the Carlton Embayment the Cockatoo Sandstone crops out as a medium to coarse-grained sandstone which is considered to have been deposited under high energy conditions in a near-shore environment. The Cockatoo Sandstone Equivalent encountered in the Bonaparte No. 1 Well consists of sandstone, shale, and siltstone which were deposited under quieter conditions in the deeper part of the embayment.

ADDITIONAL DATA FILED IN THE BUREAU OF MINERAL RESOURCES

The following additional data relating to Bonaparte No. 1 Well have been filed in the Bureau of Mineral Resources, Canberra, and are available for reference:

(i)	Well Completion	n Report, by M.C. Le Blanc	30 pp.
	Appendix 1:	Upper Devonian and Carboniferous fossils from Bonaparte No. 1 Well, by D.J. Belford, P.J. Jones, and J. Roberts	6 pp.
	Appendix 2:	Water analyses, by BMR.	2 pp.
	Appendix 3:	Core analyses, by BMR.	5 pp.
	Appendix 4:	Core descriptions by M.C. Le Blanc and G. Stephens	15 pp.
	Appendix 5a:	Log evaluation, 500 to 4962 feet, by R.H. Win	3 pp.
	Appendix 5b:	Log evaluation, 4962 to 9952 feet, by J.E. Haynes	2 pp.
	Appendix 6:	Formation testing (with pressure records), by M.C. Le Blanc	24 pp.
	Appendix 7:	Deviation survey	1 pp.
	Appendix 8:	Well velocity survey, by J.S. Thompson	3 pp.

- (ii) Daily drilling reports for period 18th July, 1963, to 6th June, 1964.
- (iii) Welex well logs including the following:
 - (a) Induction-Electric Log

```
Run 1, 100- 556 feet (1", 5" = 100 ft)
Run 2, 510- 4960 feet (1", 5" = 100 ft)
Run 3, 4904- 7956 feet (1", 5" = 100 ft)
Run 4, 7940- 9948 feet (1", 5" = 100 ft)
Run 5, 9930-10278 feet (1", 5" = 100 ft)
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(b) Acoustic Velocity Log

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Run 1, 60- 556 feet (1", 5" = 100 ft)
Run 2, 510- 4960 feet (1", 5" = 100 ft)
Run 3, 4950- 9944 feet (1", 5" = 100 ft)
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(c) Contact Caliper Log

```
Run 1, 510- 4962 feet (1", 5" = 100 ft)
Run 2, 4904- 7830 feet (1", 5" = 100 ft)
Run 3, 7800- 9950 feet (1", 5" = 100 ft)
Run 4, 9730-10280 feet (1", 5" = 100 ft)
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(d) Dip Log

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Run 1, 4904- 9949 feet (1" = 100 ft)
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BONAPARTE NO. 2

of

ALLIANCE OIL DEVELOPMENT AUSTRALIA NO LIABILITY

SUMMARY OF DATA AND RESULTS

BONAPARTE NO. 2

SUMMARY OF DATA AND RESULTS*

SUMMARY

Bonaparte No. 2 Well was located about five miles south-south-west of Bonaparte No. 1, in the Bonaparte Gulf Basin of Western Australia. It was drilled for Alliance Oil Development Australia No Liability by Reading and Bates (Australia) Pty Ltd, to total depth of 7008 feet. Drilling commenced on 25th July, 1964 and was completed on 9th October, 1964. A full programme of logging, coring, and testing was undertaken.

The well penetrated the Upper Carboniferous Point Spring Sandstone from surface to 608 feet; the Lower Carboniferous Tanmurra Formation to 1577 feet, and Milligans Beds to 6675 feet; and the Lower Carboniferous to Upper Devonian Burt Range Formation Equivalent to 7008 feet, total depth.

Fourteen drillstem tests were conducted during the drilling operation. Two of these produced gas from a thin sandstone bed in the interval 4716 to 4726 feet within the Milligans Beds. On initial test, gas flowed at a maximum rate of 1,540,000 cubic feet per day. Analysis of the gas indicated that it contains at least eight percent of higher hydrocarbons. The gas-bearing zone was retested over a 41/2-hour flow period after the well had reached total depth; during this second test the gas flow stabilized at a rate of 1,150,000 cubic feet per day. This was considered to be uncommercial and the well was plugged and abandoned.

The test drilling operation at Bonaparte No. 2 Well was subsidized under the Petroleum Search Subsidy Act 1959-1964, from surface to total depth.

^{*} Abstracted from: Well Completion Report, Bonaparte Well No. 2, by M.C. Le Blanc, Alliance Oil Development Australia No Liability, January, 1965.

WELL HISTORY

General Data

Well name and number:

Bonaparte No. 2

Location:

15⁰05'07" S. Latitude

128°43'16" E. Longitude

Name and address of

Tenement Holder:

Alliance Oil Development Australia N.L.,

100 Collins Street, Melbourne, Victoria.

Details of Petroleum

Permit to Explore 127H,

Tenement:

Western Australia

Total Depth: 7008 feet

Date drilling commenced:

25th July, 1964

Date drilling completed:

9th October, 1964

Date well abandoned:

14th October, 1964

Date rig released:

14th October, 1964

Elevation (ground):

383 feet

Elevation (K.B.):

399,6 feet (datum for depths)

Status:

Plugged and abandoned as a non-commercial gas

discovery

Cost:

£228,964

Drilling Data

Drilling Plant:

Make:

National

Type:

75

Hole sizes and depths:

20" 31 feet

17 1/2" 545 feet 12 1/4" 2563 feet

to

8 3/4" 7008 feet (T.D.) to

Casing details:

Size (in.):

Grade:

18 1/2

13 3/8

9 5/8

Weight (lb./ft):

48 H.40 36

Setting depth (ft):

31

545

J.55 2563

Logging and Testing

Ditch Cuttings:

Interval:

Ten feet from surface to total depth, reduced to five feet when coring, and in zones of special interest.

Coring:

Fifteen cores, with a total length of 199 feet and a recovery of 162 feet 1 inch (81.45%), were cut using a 30-foot, 6 7/8" OD., C.D.T. core barrel, and Mindrill diamond coreheads, Hughes drag-type coreheads, and Hughes cone-type coreheads.

Sidewall Cores:

Four samples were recovered from 39 shots fired. Halliburton equipment was used.

Electric and other logging

(Halliburton):

Induction-Electric Log:

50-7000 feet (5 runs)

Acoustic Velocity Log

with Gamma Ray:

30-7000 feet (4 runs)

Contact Caliper Log:

540-7002 feet (4 runs)

Caliper Log:

4396-6500 feet (1 run)

Dip Log:

3300-6517 feet (1 run)

Velocity Survey:

Sixteen horizons were tested between 2563 and 6501 feet. The survey was made by Petty Geophysical Engineering Company.

Temperature Survey:

Five bottom-hole temperature readings were taken by Halliburton Limited during the course of logging operations. The B.H.T. at 7005 feet was 182 F.

Deviation Survey:

Eighty readings were taken with a Totco instrument during drilling. The final reading at 7008 feet showed a deviation of 1.

Drilling Rate, Oil, and Gas Log:

Continuous drilling rate (from 31 feet) and gas plots (from 545 feet) were recorded during drilling.

Formation Testing:

Fourteen Halliburton formation tests were carried out during the drilling operation.

Ten were conducted in open hole concurrently with drilling operations; one was a misrun because of packer seat failure. An additional four tests were conducted in open hole after the well had reached total depth; one was a misrun because of packer failure.

DST No. 6 of the interval 4712 to 4819 feet flowed gas at maximum rate of 1.54 MMcf/D.

DST No. 14 of the interval 4694 to 4760 feet flowed gas at maximum rate of 1.15 MMcf/D.

Detailed results of the formation tests are given in Appendix 6 to the well completion report. Copies are available for inspection at the Bureau of Mineral Resources, Canberra.

GEOLOGY

Stratigraphy

General:

Bonaparte No. 2 Well spudded in the Upper Carboniferous Point Spring Sandstone and then penetrated the Lower Carboniferous Tanmurra Formation and Milligans Beds. The well bottomed in Lower Carboniferous to Upper Devonian Burt Range Formation Equivalent, unconformable below the Milligans Beds.

There is no essential difference between the stratigraphic sequences in Bonaparte No. 1 and Bonaparte No. 2. The Milligans Beds are 752 feet thicker in the No. 1 Well; this difference is attributed in part to a normal fault upthrown to the west, intersecting Bonaparte No. 2 at 4950 feet, and cutting out about 420 feet of the Milligans Beds. The remainder is caused by thinning of the section between the two wells.

The stratigraphic sequence encountered in Bonaparte No. 2 is shown below:

Age	Formation	Depth Intervals (feet)	Thickness (feet)				
Upper Carboniferous	Point Spring Sandstone	17 - 608	591+				
Lower Carboniferous	Tanmurra Formation	608 - 1577	969				
Lower Carboniferous	Milligans Beds	1577 - 6675	5098				
(?) Angular Unconformity							
Lower Carboniferous to Upper Devonian	Burt Range Formation Equivalent	6675 ~ 7008(T.D.)	333+				

Detailed:

Point Spring Sandstone (Upper Carboniferous, Namurian): Surface to 608 feet (591 feet +)

The upper part consists of loose, iron-stained, fine to very coarse-grained, quartz <u>sand</u>, with minor amounts of variegated, silty to sandy, very ferruginous <u>shale</u>. From 470 feet, the section consists of fine to mediumgrained, subangular to round, poorly sorted and poorly consolidated, quartz sandstone with good intergranular porosity.

Tanmurra Formation (Lower Carboniferous, Visean): 608 to 1577 feet (969 feet)

The formation consists of sandstone with lesser amounts of interbedded dolomite, siltstone, and shale.

In the upper part, the <u>sandstone</u> is predominantly light grey to brown, very fine-grained to fine-grained, quartzose, often silty, in part kaolinitic, calcareous to dolomitic, and has moderate intergranular porosity. Below 850 feet, in addition to the sandstone described above, the sequence includes numerous thick beds of very fine to very coarse-grained, very poorly sorted, angular to subangular, quartzose sandstone.

The dolomite is olive-grey to medium brown, moderately to very arenaceous, and becomes argillaceous towards the base of the formation.

The <u>siltstone</u> is grey, often carbonaceous, in part very finely sandy, in part dolomitic and argillaceous.

The shale is grey, silty, and carbonaceous.

Milligans Beds (Lower Carboniferous): 1577 to 6675 feet (5098 feet)

The formation consists predominantly of shale. Below 3274 feet, the sequence includes some interbedded sandstone and very minor siltstone.

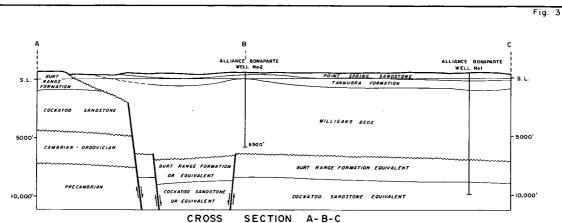
1577 to 3274 feet:

Light to dark grey and greenish-grey, non-silty to moderately silty, slightly fossiliferous shale. A bed of fine-grained, porous, quartz sandstone is present from 1742 to 1750 feet,

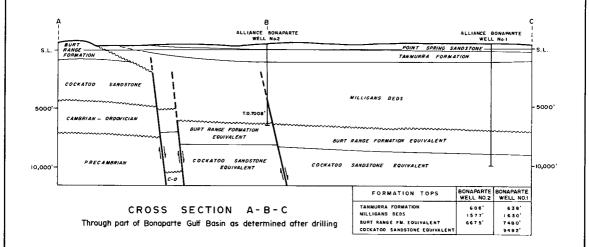
3274 to 6675 feet:

Shale with some sandstone and very minor siltstone. The shale is medium to dark grey, slightly silty and carbonaceous, and rarely slightly calcareous. Several zones of slightly to moderately sandy shale with medium to coarse quartz grains are present below 4300 feet.

On the basis of its stratigraphic position and of its electrical characteristics the sequence of shale and sandstone from 6675 feet to total depth can be broadly correlated with the Burt Range Formation Equivalent which at Bonaparte No. 1 Well underlies the Milligans Beds with slight angular unconformity. As a dipmeter survey was not conducted below 6517 feet at Bonaparte No. 2 it is not known whether the relationship between the Milligans Beds and Burt Range Formation Equivalent at this location is also unconformable.



Through part of Bonaparte Gulf Basin as assumed before drilling.



ALLIANCE OIL DEVELOPMENT AUSTRALIA N.L.
PERMIT TO EXPLORE 127 H, WESTERN AUSTRALIA

ALLIANCE BONAPARTE WELL No.2

INTERPRETED GEOLOGICAL CROSS SECTIONS BEFORE DRILLING AND STRATIGRAPHIC DATA OBTAINED FROM DRILLING



Note: Refer to Fig. 1 for location of section.

Date 9/12/64 Drafting by GEODRAFTING SERVICES.

Burt Range Formation Equivalent (Lower Carboniferous to Upper Devonian): 6675 to 7008 feet (333 feet+)

This unit consists of shale with, in its upper part, an appreciable amount of interbedded sandstone and several stringers of very sandy limestone. The shale is medium to dark grey, in part slightly silty, and sub-fissile to blocky.

The <u>sandstone</u> is light grey and brownish-grey, poorly sorted, and consists of very fine-grained to medium-grained quartz cemented with silica. The sandstone beds are usually moderately silty, occasionally kaolinitic, and in part show poor to fair porosity. Several of the beds are slightly to moderately calcareous and in part grade to very sandy limestone.

Structure

The Bonaparte No. 2 Well was located on a closed seismic structure having a minimum of 150 feet of closure mapped on a phantom horizon about 5600 feet below sea level. The seismic data indicated that the location is about 800 feet structurally higher than that of Bonaparte No. 1.

The continuous dipmeter survey conducted over the interval 3300 to 6517 feet indicated that the well intersects a fault at approximately 4950 feet. A tentative correlation of the sediments at Bonaparte No. 2 with their possible equivalents at Bonaparte No. 1 suggests that the fault is a normal one with the eastern fault-block down-thrown. The fault is correlated with a possible north-trending fault mapped on the surface, north-west of the well, in the Point Spring Sandstone.

Oil and Gas Indications and Potential

A drillstem test of a thin sandstone between 4716 and 4726 feet in the Milligans Beds, flowed gas at the rate of 1.54 MMcf/D. Analyses show that the gas contains at least eight percent of higher hydrocarbons.

Fluorescence was noted in several zones between 3500 feet and 6100 feet but drillstem tests yielded only drilling mud and salt water, and no hydrocarbons.

Porosity and Permeability of Sediments Penetrated

The Point Spring Sandstone and Tanmurra Formation consist predominantly of porous and permeable sandstones containing fresh water. The Milligans Beds contain several sandstone horizons most of which are tight, but three permeable beds having a porosity of 13 to 16 percent occur between 4541 and 4860 feet.

Contribution to Geological Concepts resulting from Drilling

The well penetrated a sedimentary sequence essentially similar to that encountered at Bonaparte No. 1, and did not make any noteworthy addition to geological knowledge of the Bonaparte Gulf Basin.

The strong gas flow which resulted from a drillstem test of a thin sandstone member of the Milligans Beds has established that source beds for hydrocarbons and suitable sandstone reservoirs are present in the Palaeozoic sediments of the Bonaparte Gulf Basin.

REFERENCES

ALLIANCE OIL DEVELOPMENT AUSTRALIA N.L.,	1964:	Surprise Creek seismic survey final report (Unpubl.).
DRUMMOND, J.M.,	1963:	Compilation and review of the geology of Bonaparte Gulf Basin, 1962. Bur. Min. Resour. Aust. Rec. 1963/133 (Unpubl.).
VEEVERS, J.J., ROBERTS, J., KAULBACK, J.A., and JONES, P.J.,	1964:	New observations on the Palaeozoic geology of the Ord River Area, Western Australia and Northern Territory. Aust. J.Sci., 26, 11.
WESTRALIAN OIL LTD, and OIL DEVELOPMENT N.L.,	1963:	Spirit Hill No. 1 Well completion report (Unpubl.).

ADDITIONAL DATA FILED IN THE BUREAU OF MINERAL RESOURCES

The following additional data relating to Bonaparte No. 2 Well have been filed in the Bureau of Mineral Resources, Canberra, and are available for reference:

(i)	Well Completion	Report, by M.C. Le Blanc	22 pp.
	Appendix 2:	Gas analyses, by BMR, and Government Chemical Laboratories, W.A.	3 pp.
-	Appendix 4:	Core analyses by BMR.	3 pp.
	Appendix 5:	Core descriptions, by M.C. Le Blanc and B. Clarke	10 pp.
	Appendix 6:	Formation testing (with pressure records), by M.C. Le Blanc	9 pp.
	Appendix 7:	Deviation survey	2 pp.
	Appendix 8:	Well velocity survey, by Petty Geophysical Engineering Company	3 pp.

- (ii) Daily drilling reports for period 17th July, 1964 to 22nd October, 1964.
- (iii) Welex well logs including the following:
 - (a) Induction-Electric Log

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Run 1, 50-538 feet (2", 5" = 100 ft)
Run 2, 540-2553 feet (2", 5" = 100 ft)
Run 3, 2564-4810 feet (2", 5" = 100 ft)
Run 4, 4800-6502 feet (2", 5" = 100 ft)
Run 5, 6450-7000 feet (2", 5" = 100 ft)
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(b) Acoustic Velocity Log (with Gamma Ray)

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Run 1, 30-534 feet (2", 5" = 100 ft)
Run 2, 540-2550 feet (2", 5" = 100 ft)
Run 3, 2564-6499 feet (2", 5" = 100 ft)
Run 4, 6490-7000 feet (2", 5" = 100 ft)
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(c) Contact Caliper Log

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Run 1, 540-2555 feet (2", 5" = 100 ft)
Run 2, 2564-4812 feet (2", 5" = 100 ft)
Run 3, 4800-6502 feet (2", 5" = 100 ft)
Run 4, 6490-7002 feet (2", 5" = 100 ft)
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(d) Caliper Log

Run 1, 4396-6500 feet (5" = 100 ft)

(e) Dip Log (with calculations)

Run 1, 3300-6517 feet (2" = 100 ft)

fossiliferous, very slightly calcareous, generally

fissile to sub-fissile.

COMPOSITE WELL LOG

COMPANY: ALLIANCE OIL DEVELOPMENT AUSTRALIA N. L.

WELL NUMBER: ALLIANCE BONAPARTE WELL No. 1 PETROLEUM TENEMENT: 127H STATE: WESTERN AUSTRALIA 4 - MILE SHEET: CAMBRIDGE GULF BASIN: BONAPARTE GULF WELL STATUS: DRY and ABANDONED LOCATION: 128° 44' 30 "E Longitude, 15° 01' 00" S Latitude OTHER SURVEYS ACOUSTIC LOG DATA INDUCTION LOG DATA CONTACT CALIPER DATA ELEVATION: Reference Pt. Ground - 339' Continuous Dipmeter Survey 4904' to 9949' K.B. K.B. - 355-3 RUN NUMBER Well Velocity Survey 6 May, 1964 24 August, 1963 18 October, 1963 18 December, 1963 6 May, 1964 19 July, 1963 25 August, 19**63** 18 December, 1963 19 July, 1963 24 August,1963 18 October, 1963 7 December, 1963 18 July , 1963 Date Spudded: 9944' First Reading 556' 9948' 4960 19 Dec., 1963 Date Suspended: 7940 4904' 78001 510' 4950 ' 9930 ' Last Reading 4994 25 April, 1964 Date Operation Resumed: 4452 Interval Measured 4 June, 1964 ___ Date Drilling Stopped: Casing Logger 510' 4904' 510' __ 6 June, 1964 Date Rig Released: 510.9 4911 4911 ____ 510.91 4911 Casing Driller 510.9 560' Ю, 283' Depth Reached 560' 7832' Total Depth Driller: 10, 530 ' K. B. 79851 IO, 283' (Corrected) 560' 4960' 10, 291' Bottom Driller 10, 291' 10, 291 4960' 10,283' (Corrected) Mud Nature Bentonite. Bentonite Bentonite Hole Size: <u>Inches</u> From 9.5 / 100 Mud Density / Viscosity 16 ' 29' K. B. 1.8 at 80°F 3.0 at 85° F 1.1 at 70° F 7·2 at 91°F 1.05 at 98°F Mud Resistivity 2**9**' 560' K. B. __ at 188°F 1.9 at 137°F -- at 216° F 1.9 at 137° F 1·9 at 137°F 560' 4964' K.B. pH / Fluid Loss cc./min. 8.5 / 6.5 8.5 / 6.5 9.0 / 5.0 9.5 / 9.0 8·5 / 6·5 9·0 / II·0 95 / 9.0 9.0 / 11.0 4964' 10,530' K. B. Circulation Origin of Sample Circulation Circulation Circulation Circulation 2 · 35 at 85°F | 0 · 75 at 98°F 2 · 35 at 85°F 2 05 at 80°F 1.25 at 70° F 3 · 20 at 85°F | 1·27 at 98°F 7.0 at 91°F 3 · 20 at 85° F 1 · 27 at 98°F 2.05 at 80° F 171/2" 121/4" 12 1/4" 121/4" 171/2" 17½" 171/2" Bit Size 83/4" 121/4" 83/4 12/4" 83⁄4" 12/4 83⁄4" Cmt'd to 9⁵/8" Intermediate 95/8" Intermediate 95/8 Intermediate 18½" Conductor 133/8" Surface 95% Intermediate Casing Size 18/2 Conductor 13⅔° Surface 9⁵/a" Intermediate 95/8" Intermediate I3¾8" Surface 95/8 Intermediate Conductor **18** ½ 29' K.B. 18·8' K. B. Myers Recorded by Bracke Myers Bracke Bracke Bracke Bracke Myers Bracke 510·9′ K.B. Surface 500 sax Surface Le Blanc Le Blanc Le Blanc Le Blanc Witness Le Blanc 4911' K. B. 300 sax. 4280'K,B. Intermediate Recovered 2500 feet of intermediate casing FOSSILS and CARBONATE CONSTITUENTS LITHOLOGIC REFERENCE POROSITY TYPE WELL SYMBOLS From Cement Plugs: Plant Crinoid Metamorphic rock (gneiss) G Glauconitic 3 Core interval, number and recovery No sample Dolomite × Intercrystalline, intergranular 1750 O Gas show slight 6 Macrofossil Conglomerate Reefoid limestone e Earthy (capillary) Formation test interval and number Argillaceous OO Gas show strong 5680' Stromatoporoid Breccia c Carbonaceous ♣ Microfossil Reefoid dolomite f Fracture Sidewall core Sandy Oil show slight s Siliceous Sandstone Evaporite F Fossiliferous (fragmental, Silty v Vugular Algae Casing shoe Oil show strong or indeterminate) ⊥ Calcareous B Bituminous Plugged interval Y Bryozoa Siltstone o Organic, bridged, intrafossil Oil and gas show Reading and Bates (Australia) Pty. Ltd. Drilled by: * Vug grown crystal +gr+ +gr+ lgneous rock (granite) Limestone Lithic carbonate fragments FI Fluorescence Logged by: Shale, claystone, mudstone Ø Concretion Reading and Bates (Australia) Pty. Ltd. V_bV_V Volcanic rock (basalt) <u>v</u> Circulation loss partial Perforated interval Cemented by: ø Pellets, pseudo oolites Drilling Method: <u>vv</u> Circulation loss complete Dipmeter results (dip and azimuth) Gas cut mud oo Molluscs or brachiopods Lithology by: Le Blanc, Stephens Drafting by: GEODRAFTING SERVICES DRG. No. O.D./313 RESISTIVITY R E S I S T I V I T Y ohms m²/m RESISTIVITY SPONTANEOUS POTENTIAL ohms m²∕m TRATIGRAPHIC ohms m²/ m COLUMN BIT TYPE 18" Normal 16' Lateral DRILLING RATE DRILL STEM TEST MUD GAS DEPTH LITHOLOGY INTERPRETED CALIPER LITHOLOGIC DESCRIPTION DETECTION feet I·5" Laterai REMARKS LITHOLOGY Hole diameter in inches Induction Resistivity 500 500 Induction Conductivity
40" Induction Mmhos m²/m 4 8 12 16 20 24 16 - 60' SAND Loose, colorless, round, frosted quartz grains with 20% <u>Sandstone</u>: white, medium grained, round quartz. Z Kaolinitic to ferruginous cement, friable. \ D-1 60 – 250' 0 0 White, in part mauve and yellow (stained), medium becoming medium to coarse grained, round to subround S quartz, medium sorting, very friable, some kaolinitic Z Granges cement, very good intergranular porosity. ⋖ 250 - 295' SHALE S Yellowish grey and medium brown, slightly micaceous and silty, iron stained, brittle, sub-fissile. Z 295 - 638' SAND 0 Colorless to white, medium to very coarse, round, commonly frosted, quartz grains. ധ | മ In the interval 295-390' the sand includes up to Z $\mathbf{\alpha}$ 20% colored quartz grains and lithic fragments. α \ D- 2 **Q** S Granges From 560' onwards there is some poorly consolidated Sandstone: fine to medium grained, subround quartz, 0 Kaolinitic cement, good earthy and intergranular D - 3 C-1 Truco ◊ م | مـ ←20→ Change of Scale Change of Scale RUN 2 RUN 2 D-3RR 638 - 725 LIMESTONE STA Buff to medium grey, medium grained oolite with sandy, silty and argillaceous matrix; grading downwards to very sandy, slightly oolitic, coarse grained calcirudite; then to slightly arenaceous, very fine to fine grained <u>calcarenite</u>. 725 **–** 7**8**0′ T.O. 35 S.I. 12 8 14 725 - 740' SILTSTONE Rec. 430 m.c. water. 1HP 350 FHP 350 1SIP 230 FSIP 350 1FP 175 FFP 230 Brownish grey, sandy and calcareous. \D-4 740 - 830' SANDSTONE Very fine grained, angular quartz, poorly sorted, calcareous, earthy porosity, with 15% Interbedded silty and sandy, crypto-crystalline to microcrystalline limestone. 830 - 860' SILTSTONE 0 890 **- 9**55 Greenish grey, sandy and calcareous. 7.0,28 mins, S.I.12 & C Rec. 720' sl- m.c.wate Recrystallized very fine to fine grained calcarenite; with IFP 280 F.FP345 30% very fine grained, calcareous sandstone SANDSTONE White to medium grey, very fine to medium grained, angular quartz, friable, calcareous, fair to very good porosity. 985 - 998' PEBBLY SANDSTONE Granule sized, angular quartz, in matrix of Sandstone; as above; plant remains. Granges White, fine to medium grained, subangular quartz, green pink and black accessories, friable, very slightly pyritic, abundant dolomitic matrix, fair porosity. Very finely crystalline, very sandy. 1113 – 1308 SANDSTONE Light grey and brownish grey, fine to medium grained, 7, 0, 33 mins S.I. 12 & 10 Rec. 1040'sl, m.c. water angular to subangular quartz, pink green and black C-1RR IHP 760 FHP 715 ISIP 505 FS.IP 490 IFP 460 FFP 480 accessories, some bioclastic fragments, slightly pyritic, rarely fossiliferous, poor to medium earthy and intergranular porosity, up to 40% dolomitic carbonate matrix; in part grades to very sandy, calcareous dolomite. Interbeds of dark grey, slightly carbonaceous, argillaceous 1308-1342 1342-1382' INTERBEDDED and GRADATIONAL SANDSTONE (65%) and DOLOMITE (35%). STA Sandstone: pale brown, medium grained quartz, abundant carbonate cement, crinoidal, fair porosity. <u>Dolomite:</u> recrystallized, crinoidal, bioclastic and fragmental carbonate, fossiliferous, slightly calcareous. SANDSTONE White, very fine to medium grained, subangular quartz, ----slightly fossiliferous, kaolinitic (?), up to 40% crystalline dolomitic cement, fair to good porosity; grades in part to sandy dolomite; occasional interbeds of dolomite C-2 SFCH Light brown, very fine to fine grained calcarenite, in part Rec: 1670'mud pelletoidal, moderately sandy, grades to sandstone. Granges 1630-- 1640' HP 760 FHP 750 White, fine to medium grained quartz, kaolinitic and calcareous cement, very good porosity. INTERBEDDED and GRADATIONAL SILTSTONE (45%), SHALE (45%) and SANDSTONE (10%). Siltstone: medium grey, slightly carbonaceous, v. argillaceous Shale: medium grey, moderately to very silty, blocky. Sandstone: brown, fine to medium grained quartz, abundant carbonate cement, Occasional sandy dolomite. Medium light greenish grey, moderately sandy and silty, chunky; becoming fossiliferous (Crinoids, microfossils) and sub-fissile. C-3 HFHC 1830 - 1928' SHALE Medium light grey, moderately silty, very slightly calcareous, fossiliferous; with 15% <u>Limestone</u>; medium D - 10 light brown, fine to medium grained bioclastic, fragmental, pyritic. Basal bed of pelletoidal, sandy and silty limestone. Granges 192**8** – 2072' Medium light grey, moderately silty, slightly fossiliferous, subfissile; possibly grades to claystone in large part Abundant concretionary and bedded ironstone. Occasional argillaceous siltstone interbeds. Rare silty fragmental limestone. 2072 - 2096' SILTSTONE Medium brownish grey, argillaceous, fossiliferous, very calcareous; grades to <u>Limestone</u>: light brown, fine grained bioclastic, sandy. 2096-2304' SHALE ST3 \ Medium light grey, slightly silty becoming moderately to very silty, in part slightly carbonaceous, slightly micaceous, slightly fossiliferous, sub-fissile to blocky. Common zones of concretionary and bedded ironstone. 2304 - 2318' SILTSTONE – 2200 – 1 + 1 + WWWW W Medium light grey, moderately argillaceous, slightly Ď-11 R R sandy and micaceous. 2318 - 2372' SHALE Globe Medium grey, slightly silty, moderately fossiliferous ST3 Σ (crinoids), sub-fissile; with occasional ironstone. 2372-2404' SILTSTONE grading to SANDSTONE Medium grey, sandy and argillaceous siltstone grading to <u>Sandstone</u>: light grey, very fine to fine grained, 0 subangular quartz C-4RR 2404 - 2564' SHALE Medium light grey, soft, in part slightly silty, slightly

D - 12

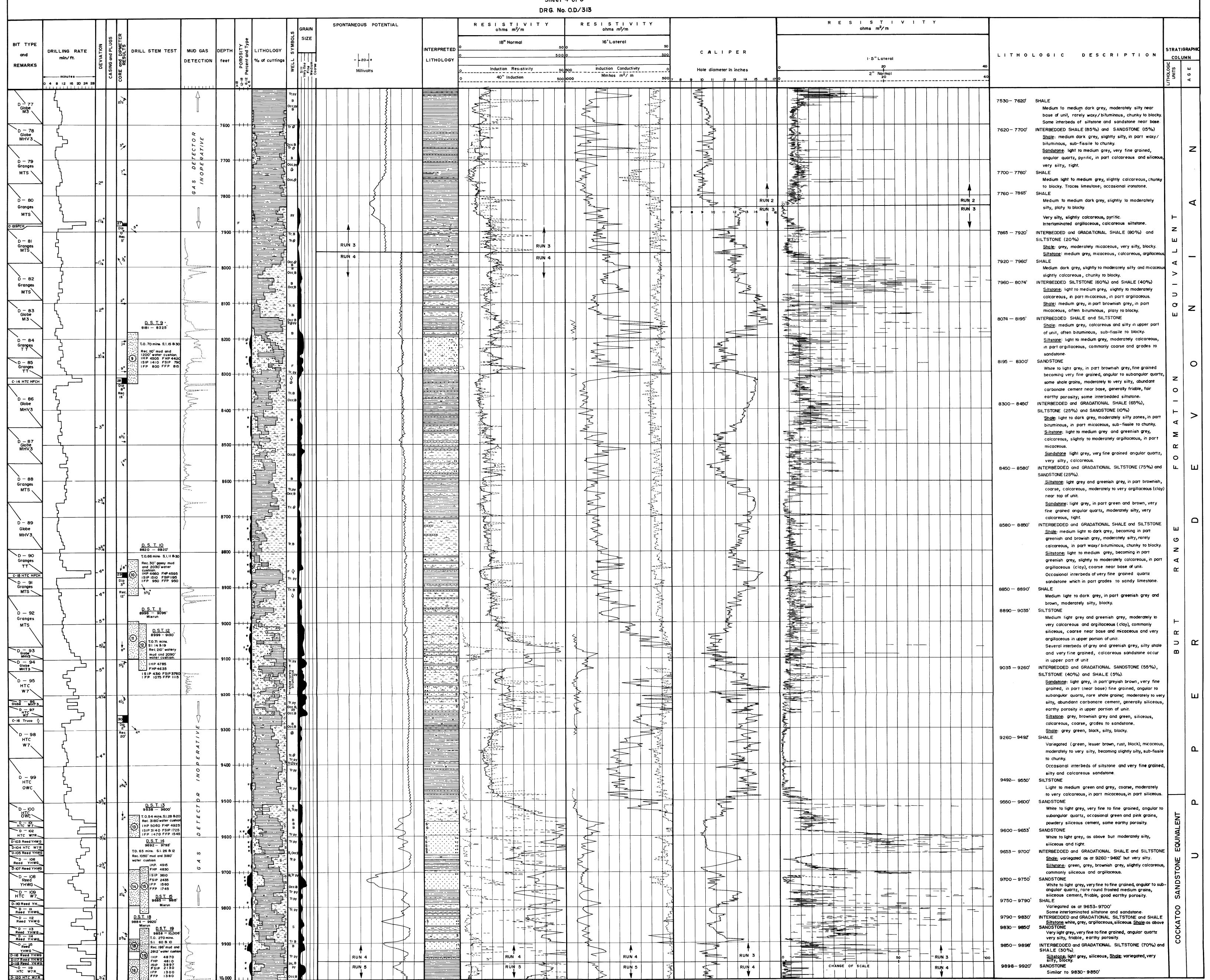
Granges TT

COMPOSITE WELL LOG
ALLIANCE BONAPARTE WELL No.1
5000 - 7500'
Sheet 3 of 5

Sheet 3 of 5 DRG. No. O.D/313									
SPONTANE OUS POTENTIAL GRAIN SUBJECT OF STATE	RESISTIVITY ohms m²/m	RESISTIVITY ohms m²/m	RESISTIVITY ohms m²/m						
BIT TYPE and DRILLING RATE NOTE TO SEE THE STEM TEST MUD GAS DEPTH SEE TO SEE THE S	INTERPRETED O O LITHOLOGY	16' Lateral 50 0 50 500 CALIPER	I-5" Lateral	LITHOLOGIC DESCRIPTION COLUMN					
REMARKS O	n to induction	50,500 Induction Conductivity 0 Mmhos m²/m 500 7 8 9 10 11 12 13 14 15 16	0 20 2" Normal 20 20	HOLOGE THOLOGE					
D — 30 Globe M3 184 184 186 186 186 186 186 186				5000 — 5096' SHALE Medium light to dark grey, in part slightly silty, fissile to platy. At 5023 — 5027' Sandstone: very fine to fine grained, subangular quartz, dolomitic cement, tight.					
D — 31 Granges T T				5096 — 5130' SHALE Medium to dark grey, very silty zones, fissile Interbedded Sandstone: white, very fine to medium grained, tight and					
D - 32 Granges T T				Siltstone: brownish grey, very argillaceous. 5130 — 5238' SHALE Medium grey, occasionally slightly silty, platy to sub-fissile;					
C-5 RR C-7 HTC HFCH Ay2 Rec. 17 10 17 10 18 10 19 10 10 10 10 1				common white calcite veining and slickensided surfaces. 5238—5362' SHALE Dark grey, in part slightly silty, rarely slightly calcareous,					
D — 33 Giobe M3 5300 5300				occasional ironstone. 5362 — 5390' SANDSTONE					
(A) Lyppose Europes (C)				White to brown, subangular to subround quartz, white to brown carbonate cement, some earthy porosity. Possibly grades to basal silty shale. 5390 - 5610' SHALE					
Globe S T 3 IFP 50 FFP 30 5400 1 1 1 1 1 1 1 1 1				Medium grey, in part slightly calcareous, sub-fissile. Thin interbeds of <u>Sandstone</u> : white to brown, very fine to fine grained, brown carbonate cement.					
D-35 Globe M3 5500 F				Ironstone common from 5500 to 5520' 5610 - 5650' SANDSTONE O					
C-5 RR Truco () D-36 Granges TT Qcc 9				White, fine to medium grained subangular quartz, well sorted becoming poorly sorted and coarse near base, siliceous and calcareous cement, good earthy					
D-37 Globe M3 D.S. T.6 Second py				and intergranular porosity. 5650 - 5734' SHALE Medium grey, rarely greenish and brownish, slightly sandy and silty, in part waxy, fissile to blocky.					
D-38 Globe M3 To 46 mins. S, 1, 19 8 19 Rec. 360'w. c. mud, 10 90'sl. sul. gassy salt water				Occasional very fine to fine grained sandstone; occasional ironstone. 5734 - 5856' SHALE					
D — 39 Globe MHV 3 D — 40 I HP 3050 I SIP 2285 FSIP 2285 I FP 290 FFP 700 Occθ Occθ Occθ Occθ				Medium to medium dark grey, in part silty, platy to chunky; common interbeds of calcareous and siliceous sandstone and some siltstone near base of unit.					
Globe H 3 C-8HFCH C-9HFCH C				5856-6063' SHALE Medium light to medium grey, slightly to moderately silty, fissile to blocky; with 5-10% interbedded Siltstone:					
D-41 Dip 3° Rec. 4'3' Tro				argillaceous, in part calcareous, in part siliceous. Occasional interbeds of <u>Sandstone</u> : medium dark brown,					
Globe H 3 Globe F 7				very fine grained, abundant carbonate cement, some organic debris. 6063 - 6073' SILTSTONE (?) Medium grey and brownish grey, siliceous and argillaceous.					
D - 42 Globe D. S. T.7 D. S. T.7				6073 — 6100' SANDSTONE White to buff, very fine to fine grained, angular quartz, slightly calcareous, powdery siliceous cement, fair earthy					
MHV3 3½ 6076 - 6110 Misrun 90000 py py				porosity. 6100 — 6224' SHALE Medium light to medium dark grey, rarely greenish,					
Globe MHT3 D-44 Globe H3 J/2 Sight py				slightly silty, rarely sandy, fissile to chunky. Occasional interbeds of very fine to fine grained, calcareous sandstone and argillaceous siltstone.					
D - 45 Granges				6224—6264' SHALE Medium grey, moderately to very silty, platy to chunky; some ironstone. 6264—6453' INTERBEDDED SHALE (75%), SILTSTONE (15%) and					
T,0,72 mins. S,1,36 & 29 C-IO Truco () Granges MTS. Dip 1HP 3235 FHP3200 IS IP 1105 FSIP 440				SANDSTONE (10%). Shale: medium to dark grey, some moderately silty zones, sub-fissile to chunky.					
Globe Hw3 D - 48 Granges TD D - 49				Siltstone: medium grey to brown, argillaceous, siliceous; becomes sandy and calcareous near base of unit. Sandstone: white, grey, brownish grey, very fine grained					
Granges TD 6400				quartz, siliceous, becomes calcareous, tight. Occ. ironstone. 6453 — 6526' INTERBEDDED SHALE (70%) and SANDSTONE (30%) Shale: medium grey, slightly to moderately silty, in part					
D - 50 Granges D S T. 0. 60 mins. S.l. 60 8 60 Rec. 715' mud.				coarsely sandy, platy to chunky. Sandstone: white, fine grained, angular quartz, very silty, poorly sorted, with common medium to coarse grains, in part siliceous, moderate earthy porosity.					
D - 51 Globe HW3 D - 52 Granges TD 1.H.P. 3240 F.H.P. 3132 I S IP 2670 FSIP 2240 I F P 350 FFP 350	5. C.			6526—6592' SANDSTONE White to buff, very fine to fine grained, angular quartz, moderately sorted, rarely carbonaceous,					
D - 53 D - 54 D - 54 Granges T D REFER D - 40 Ref. D - 40 Ref. D - 40 Ref. D - 40 Ref. D - 55 Granges D S D - 56 Granges D S D - 57 Granges D S D -	· · · · · · · · · · · · · · · · · · ·			■					
HTC D-58 Granges DS D-58 RR Granges DS D-59 Granges DS D-59 Granges DS D-59 Granges DS				6592—6984' INTERBEDDED SHALE, SANDSTONE and SILTSTONE Shale: medium to medium dark grey, in part brownish grey, moderately silty, in part micaceous, rarely bituminous, slightly sandy near base of unit,					
Granges DS D - 62 Globe MHT3 D - 63 Truco Granges DS A 6700				platy to blocky. <u>Sandstone</u> : white to medium grey, very fine to fine grained, angular to subangular quartz, poorly sorted,					
Diamond Diamond D - 64 HTC W7R HTC W7R	S			slightly to moderately calcarecus, rarely pyritic, tight, very siliceous and in part grades to orthoquartzite. Siltstone: grey, siliceous, in part argillaceous,					
D - 65 HTC W7R D - 66 HTC W7 Py				occasionally pyritic and sandy. 6984 - 7010' SANDSTONE Buff to light grey, very fine to fine grained,					
D - 67 HTC W7 D - 68 HTC W7				angular to subangular quartz, silty, poorly sorted (some medium to very coarse grains), brown clay cement, siliceous, slightly friable, some earthy porosity					
D - 69 HTC W7 D-700WC C-II RR DIP 41/2 D- 71				7010 — 7090 SHALE Medium grey, commonly moderately to very silty, slightly sandy near base of unit, platy to chunky.					
HTC W7 D - 72 HTC OWC 3½ 3½ 4 5 5 5 6 6 6 7 6 6 7 8 8 8 8 8 8 8 8 8 8 8 8				Occasional silty, siliceous sandstone and siliceous siltstone.					
D-73 HTC OWC	5	3		Light grey, very fine grained, angular quartz, some shale grains, silty, siliceous, tight. 7100 — 7160' SHALE					
D - 74 HTC OWC				Medium light to medium grey, in slight part silty and sandy, platy to blocky. 7160 — 7480 SHALE					
OWC C-12 HTC HFCH Dipo 5-8	<u> </u>			Medium to medium dark grey, in part brownish grey, in part micaceous, generally slightly silty, some very silty zones, rarely sandy, rarely pyritic, sub-fissile to chunky; becomes bituminous near					
D — 75 Granges MTS MTS				sub-fissile to chunky; becomes bituminous near base of unit. 7480 — 7530 SHALE Medium to medium dark grey, slightly silty, rarely					
7400 - 3°				bituminous, platy to chunky. Interbeds of siltstone are likely present but were not recognised in the cutting samples.					
D — 76 Granges MTS 3°# 3°#									
7500 Tr py				-?-					

COMPOSITE WELL LOG ALLIANCE BONAPARTE WELL No.1

7500 - 10,000 Sheet 4 of 5



COMPOSITE WELL LOG

ALLIANCE BONAPARTE WELL No.1 10,000-10,530'

Sheet 5 of 5 DRG. No. O.D./313

		DRG. No. O.D./313		
REMARKS Minutes Minut		RESISTIVITY RESISTIVITY Ohms - m²/m Ohms - m²/m	RESISTIVITY Ohms-m²/m 1.5" Lateral 50 2" Normal 50	LITHOLOGIC DESCRIPTION STRATIGRAPHIC COLUMN 100 100 100 100
D-132 HTC W7R D-132 RR HTC D-133 W7R D-134 HTC W7R D-135 HTC W7R D-136 HTC W7R D-136 HTC W7R D-140 Globe MHT3 D-141 Globe MHT3 HTC W7R D-142 HTC W7R D-143 HTC W7R D-144 HTC W7R D-145 HTC W7R	Tr. py Tr. py			in part silty, becomes calcareous near base of unit. Siltstone: grey and greenish grey, slightly calcareous. Sandstone: as above, tight.

COMPOSITE WELL LOG

ALLIANCE OIL DEVELOPMENT AUSTRALIA N.L.

ALLIANCE BONAPARTE WELL No.2

PETROLEUM TENEMENT: 127H

STATE: WESTERN AUSTRALIA

BASIN: BONAPARTE GULF

WELL STATUS: PLUGGED and

LOCATION: 128° 43′ 16″ E. Longitude 15° 05′ 07″ S. Latitude

ELEVATION: Reference Pt. Ground 383 feet K. B. 399.6 feet

Date Sp	oudded:	25 July, 1964
Date Dr	illing Stopped:	9 October, 1964
Date Ri	g Released	14 October, 1964
Total De	epth: Driller	7008 ' K. B.
	Logger	7005' K. B.
Hole Siz	<u>e</u> <u>Inches</u>	<u>From</u>

Hole Size	<u>Inches</u>	<u>From</u>	<u>To</u>			
	20	16.6,	31'			
	17 <i>/</i> ≥	16 · 6'	5 45'			
	اُع ^{ُا} لِمِ	5 4 5 '	25 63'			
	83/4	2563'	7008			
Çasing	<u>Inches</u>	<u>Wt</u> .	<u>Gr.</u>	<u>Depth</u>	<u>Cmt.</u>	<u>Cmt'd to</u>
	181/2			31' K.B.	35 sacks	19∙0' K.B.
Conductor						
Surface	13 ³ /s	48	H-40	545'K.B.	480 sacks	19·1' K.B.
	_				700	1000 140

Cement Plugs	From	<u>To</u>	Sacks	Felt at
No. I	6050'	6200'	65	Not felt for
No. 2	5700'	58001	55	Not felt for
No.3	4760'	4900'	100	4760
No. 4	4450'	4600'	100	Not felt for
No.5	2500'	26 20'	100	Not felt for
No.6	19'	31'	20	19'

Reading & Bates (Australia) Pty. Ltd.

Logged by:

4-MILE SHEET CAMBRIDGE GULF

ABANDONED NON-COMMERCIAL MILLIGANS BEDS GAS DISCOVERY

Velocity Survey

OTHER SURVEYS

Continuous Dipmeter Survey 3300' to 6517'K.B.

	INDU	CTION EL	ECTRIC L	OG DAT	Α	CONTAC	T CALIPE	R LOG	DATA	ACOUSTI	C VELO	CITY LOG	DATA
RUN NUMBER	1	2	3	4	5	1	2	3	4	1	2	3	4
Date	July 29, 1964	August II, 1964	September 7, 1964	October I, 1964	October 9, 1964	August II, 1964	September 7, 1964	October I, 1964	October 9, 1964	July 29, 1964	August II, 1964	October I, 1964	October 9; 1964
First Reading	538'	2553'	4810'	6502	7000'	2555'	4812'	6502'	7002'	534'	2550'	6499'	7000
Last Reading	50'	540'	2564'	4800'	6450'	540'	2564'	4800'	6490'	30'	540'	2564'	6490'
Interval Logged	486'	2013'	2246'	1702'	550'	2015'	2248'	1702'	512'	504'	2010'	3 935'	510'
Depth Reached	542'	2558'	4815'	6503'	7005	25 58'	4815'	6505'	7005'	542	2558'	6505'	70051
Depth Driller	544'	2563'	4817'	6527'	70081	2563'	4817'	6527'	7008'	544'	2563'	6527'	7008'
Casing Logger		540'	2564'	2564'	2564'	5 40'	2564	25 64'	2564'		5 40'	2564'	2564'
Casing Driller	-	545'	25 63'	2563'	25 63'	5 45'	2563'	2563'	2563'		545'	2563'	2563'
Casing Size		13 ³ / ₈ " Surfac e	978" in termediate	95/8" Intermediate	9 ⁵ /8 ["] Intermediate	13 ³ / ₈ " Surface	9 ⁵ / ₈ "Intermediate	95/8" Intermediate	95/g Intermediate		13 ³ /8 Surface		95/8 Intermediate
Bit Size	171/2"	171/2"	17½" 12¼"	171/2" 121/4"	171/2" 121/4"	171/2"	171/2" 121/4"	171/2" 121/4"	171/2" 121/4"	171/2"	17½"	171/2" 121/4"	171/2" 121/4
Bit Size 2		121/4	8 ³ /4	8 ³ ⁄4"	B ³ /4	121/4	83/4"	83/4"	8 3/4"		121/4	8 ³ / ₄ "	83/4"
Mud Type	Bentonite	Bentonite	Bentonite	Bentonite	Bentonite	Bentonite	Bentonite	Bentonite	Bentonite	Bentonite	Bentonite	Bentonite	Ben tonite
Density / Viscosity	9·4 / 60 ,	10.0 / 50	10·2 / 58	10.5 / 98	10-4 / 118	10.0 / 50	10.2 / 58	10.5 / 98	10-4 / 118	9.4 / 60	10-0 / 50	10-5 / 98	10.4 / 118
pH / Fluid Loss	10.2 / 8.5	11.0 / 3.4	9.0 / 3.2	8-9 / 4-0	8.5 / 5.0	11.0 / 3.4	9.0 / 3.2	8.9 / 4.0	8.5 / 5.0	10 · 2 / 8 · 5	11.0 / 3.4	8.9 / 4.0	8.5 / 5.0
Mud Resistivity	5.5 (D) 80°F	1.05 Ø 96°F	1.82 @ 80°F	1.40 @ 90°F	l·60 @0 90°F	I·05 @ 96°F	1-82 @ 80°F	1·40 @ 90°F			1.05 @ 96°F	1·40 @ 90°F	1.60 @ 90°F
Mud Resistivity BHT	3.7 @ 120°F	0·79 @ 132°F	1-05 6 151°F	0.75 @ 180°F	0.80 @ 182°F	0.79 @ 132°F	1.05 @ 151°F	0.75 @ 180°F		3·7 @ 120°F	0.79 6 132°F	0.75 @ 180°F	0.80 to 182°F
Rmf	6.05 to 80°F	0·95 (0) 96°F	I-28 (0 80°F	0.95 0 90°F	1.20 @ 90°F	0.95 @ 96°F	1-28 (D 80°F	0.95 Ø 90°F	<u> </u>	<u></u>	0.95 Ø 96°F	0.95 @ 90°F	1·20 () 90°F
Rmc	3·7 @ 80°F	1-15 () 96°F	2·02 @ 80°F	1.90 @ 90°F	I-90 Ф 90°F	I·15 @ 96°F	2·02 @ 80°F	1.90 @ 90°F	1.90 6 90°F	3.7 Ø 80°F	1·15 ₽ 96°F	I·90 Ø 90°F	1.90 @ 90°F
Recorded by	Bracke	Bracke	Bracke	Bracke	Bracke	Bracke	Bracke	Bracke	Bracke	Bracke	Bracke	Bracke	Bracke
Witness	Le Blanc	Le Blanc	Le Blanc	Le Blanc	Le Blanc	Le Blanc	Le Blanc	Le Blanc	Le Blanc	Le Blanc	Le Blanc	Le Blanc	Le Blanc

<u>well</u>	SYMBOLS	<u>L</u>	ITHOLOG	1 C	REFE	REN	<u>C E</u>	PORO	SITY TYPE	FC	SSILS AND CARBONATE CONSTITUENTS
	Fluorescence Gas zone Circulation loss partial Circulation loss complete Core interval, number and recovery Sidewall core Formation test, interval and number Casing shoe		No sample Conglomerate Sandstone Siltstone Shale Limestone Dolomite	- - - - - - -	Argillaceous Sandy Silty Calcareous Dolomitic Micaceous Cherty	C S Fe	Pyritic Carbonaceous Siliceous Ferruginous Concretion		Intergranular, * Intercrystalline • Earthy (capitlary)	O	Coral Bryozoa Lithic carbonate fragments (includes calcilutite, calcirudite) Molluscs or brachiopods
$\overline{\triangle}$	Plugged interval									F	or indeterminate

Lithology by:	Halliburton Limited Le Blanc and Clarke		Z Plugged interval		F Fossiliferous (fragmental or indeterminate				
					· · · · · · · · · · · · · · · · · · ·	Drafting by GEODRAFTING S Dec			
	deviction in hole) UGS and Dips	P P P P P P P P P P P P P P P P P P P	POTENTIAL GRAIN SIZE	RESISTIVITY RESISTIVITY Ohms-m²/m 18" Normal 16' Lateral	RESISTIVITY Ohms-m²/m		STRATIGRAPI COLUMN		
BIT TYPE and REMARKS	DEVIATION (::: % The state of t	ORMATION TESTS GAS DETECTOR HTDBOCARBONS and HYDROCARBONS AND	(Average In IO foot interval)	RPRETED HOLOGY Induction Resistivity O	1·5" Lateral 20 40 2" Normal 40	LITHOLOGIC DESCRIPTION	LITHOLOGIC UNIT		
	1/2°	100				16 - 31' No samples 31 - 100' SAND Loose, iron-stained (light orange to brown), medium to very coarse, subround to well rounded, frosted quartz grains; trace of ferruginous cement. 100-130' No samples	ONE		
D- Granges		200 - 200 -				Loose, colorless to iron — stained, medium to coarse, subround to round quartz grains and rare lithic fragments. The sand is very poorly sorted and includes some fine grains and abundant angular to subangular grains. Up to 5% <u>Sandstone</u> : very fine to medium grained, quartz, very friable and porous, kaolinitic and ferruginous cement.	SANDST		
ST		GAS DETECTOR				300-500' SAND, SANDSTONE and SHALE Sand: loose, iron-stained (yellow, brown, orange, pink), poorly sorted, round to subround, fine to medium, quartz grains, and angular to subangular, coarse to very coarse grains Shale: mauve, brown, ochre and pink, very ferruginous, sandy to silty. From 370' onwards there is from 10 to 45 percent of	SPRING ABBON		
D-2 Granges ST		400 3 = 1		Change in Scale see Sheet 2		Sandstone: very fine to medium grained, subround to subangular quartz, in part calcareous, ferruginous and kaolinitic cement, porous. 500-530' No samples 530-545' SAND as above with 20 percent SANDSTONE	F N - O d		
		600 × • • • • • • • • • • • • • • • • • •	RUN 2	RUN 2	RUNI	545-608' SANDSTONE Iron-stained (light yellow and orange), fine to medium grained, subangular to round quartz, poorly sorted with some coarse grains, very poorly cemented, very porous. 608-650' SHALE Light grey, moderately silty and carbonaceous. At 637-643' Siltstone: grey, argillaceous, very finely sandy.	z		
D-3 Globe ST3		700 x • 700 c c c c c c c c c c c c c c c c c c				Interbedded SANDSTONE, SILTSTONE (15%) and SHALE (10%). Sandstone: light grey and brown, becomes medium grey, very fine to fine grained, becomes, in part medium grained, in part argitlaceous, cement is variable (kaolinitic, dolomitic, calcareous); generally slightly porous; commonly silty and in part grades to siltstone; occasionally with very abundant dolomitic matrix. Siltstone; grey, argillaceous and carbonaceous, very finely sandy and in part grades to sandstone. Shale: light to dark grey, carbonaceous and pyritic, often very silty and in part grades to siltstone.	int O		
		900				850-1043' SANDSTONE, SILTSTONE and DOLOMITE Sandstone: buff to medium greyish brown, very fine to medium grained, angular to subangular quartz, abundant dolomitic carbonate matrix, in part tight but generally has good intergranular porosity. Some Sandstone: light grey, very fine grained, angular quartz, silty, tight.	∀		
C-I HTC HFCH	Dip 2° Rec. 9'4"					Siltstone: buff, grey, green, dolomitic, in part argillaceous, very finely sandy. Dolomite: medium greyish brown, very silty and sandy. 1043-1122' Interbedded SAND and 35 percent SANDSTONE and SILTSTONE Sand: loose, fine to coarse, subangular to round, vitreous quartz grains.			
Globe ST3		1200	c c			Sandstone and Siltstone as at 850—1043' Interbedded SANDSTONE, SILTSTONE and SHALE Sandstone: light grey, very fine to fine grained, angular to subangular quartz, moderately to very silty, tight. Siltstone: medium grey, carbonaceous, moderately to very argillaceous, in part sandy. Shale: medium grey, carbonaceous, silty, in part slightly pyritic.	4		
D-5	-1/2	X	c			Interbedded SAND, SANDSTONE, DOLOMITE (20%) and SILTSTONE (15%). Sand: colorless, in part slightly iron—stained, fine to coarse grained, subangular to subround quartz grains with common pale blue grains of milky quartz. Sandstone: variable: predominantly clean, very porous, medium to coarse grained but in part light to dark grey, very fine grained argillaceous, carbonaceous, tight. Dolomite: olive grey to medium brown, moderately to very silty	od, C		
Globe ST3		D.S.T. No. 1	c			and/or argillaceous, in part pyritic, in part sandy. Siltstone: medium grey, carbonaceous, moderately to very argillaceous, pyritic. 1394-1444' DOLOMITE grading to SILTSTONE Dolomite: clive grey and brown, microcrystalline, very silty, slightly calcareous. Siltstone: light grey, very dolomitic, in part carbonaceous & argillaceous interbedded SANDSTONE, SILTSTONE and SHALE Sandstone: very fine to fine grained, silty, in part calcareous.	. Z		
Globe ST3	Dip	1508 - 1715' T.O. 35 mins. S.I. 20 a 24 mins. Rec. 180' mud and 947' fresh water. LHP 720 FHP 720 LSIP 540 FSIR 535 LFP 440 FFR 535				Siltstone: light grey, argillaceous, carbonaceous. Shale: medium light grey, slightly silty, fossiliferous (crinoids). 1516—1577' SANDSTONE Colorless to light grey, very fine to very coarse grained, angular to subangular quartz, predominantly coarse grained, rare green clay grains, occasional iron—stained grains, common blue quartz grains very poorly sorted and cemented, excellent intergranular porosity. 1577—1700' SHALE	∀ ⊢		
D-7 Globe ST3	-1°	D. S.T. No. 2 1718 - 1925	F F G G G G G G G G G G G G G G G G G G			Light to medium grey, moderately to very silty in part, rarely slightly calcareous, slightly fossiliferous (crinoid debris), sub — fissile to platy. Common Ironstone: brown, very argillaceous and silty, dolomitic. At 1577 — 1590' and 1610 —1620' <u>Siltstone</u> : light to medium grey, slightly argillaceous and carbonaceous. 1700—1742' SHALE Medium grey, moderately to very silty, carbonaceous, very slightly fossiliferous (crinoidal).	S		
D-8 Granges TT		T.O. 60 mins. S.I. 29 & 22 mins. Rec 20' mud and 420' fresh water I:H.P. 870 F.H.P. 800 I.S.I.P. 620 F.S.I.P. 605 L.F.P. 50 F.F.R. 195	C C C C C C C C C C C C C C C C C C C			Very light grey, fine grained, subround to subangular quartz, slightly calcareous, friable, good intergranular porosity. 1750-1970' SHALE Light to medium dark grey, greenish grey and olive grey, slightly carbonaceous, very slightly fossiliferous, in part moderately to very silty, chunky to sub-fissile. Common ironstone: medium to dark brown, dense, very dolomitic; in part silty and argillaceous and grades to dolomitic shale and silty, argillaceous dolomite. Occasional interbed of Siltstone; medium grey, carbonaceous, very argillaceous, slightly calcareous, in part slightly sandy.	В		
D-9 Globe SȚ3	-2° -2° -1%	2000				1970-2240' SHALE Light to medium dark grey and greenish grey, occasionally stightly silty, slightly carbonaceous, in part slightly pyritic, slightly fossiliferous (dolomitised crinoid fragments, rare coral, gastropod and brachtopod remains), fissile to sub- fissile. Several interbeds of argillaceous Siltstone are present	S		
C-2 HTC SFCH	ı'/ ₄ ı'/ ₂ ı'/ ₂ ı'/ ₂	2100	β F		Com toward And The Andrew	in the interval 2000 - 2030'	8 P		
D-10 Granges T T	Dig ½° Rec. ¾° ½°	2300 +++	C C S S S S S S S S S S S S S S S S S S		And to find the second of the	2240-2330' SHALE Light to medium grey, in part moderately silty, rarely micaceous, fissile to sub-fissile. Common interbeds of <u>Ironstone</u> .			
	-23/2 23/2	2400 + + + + = = = = = = = = = = = = = = =	POF 0000		A Proposition of the Contract	Medium light to medium grey, in part greenish and brownish grey, slightly to moderately waxy, occasionally slightly silty, in part slightly micaceous, very slightly fossiliferous, fissile to chunky. Scattered zanes of bedded and concretionary <u>Ironstone</u> . 2480-2540' SHALE Medium light to medium dark grey and greenish grey, waxy to carbonaceous, commonly slightly to moderately silty, chunky; with common interbeds of <u>Siltstone</u> : light to medium grey and greenish grey, argillaceous, in part very carbonaceous, slightly calcareous, in part siliceous.	Σ		

COMPOSITE WELL LOG ALLIANCE BONAPARTE WELL No.2

2500 - 5000¹ Sheet 2 of 3

	2500 Sheet	- 5000' 2 of 3			
DIPMETER RESULTS True North SUD SIZE	POTENTIAL	RESISTIVITY RESISTIVITY Ohms - m²/m Ohms - m²/m	RESISTIVITY Ohms m²/m		STRATIGRAPHIC COLUMN
BIT TYPE and DRILLING RATE Min./ft. DEFENDABLES DEFEND		la	I·5" Lateral	LITHOLOGIC DESCRIPTION	FIND
TEMMACKS OPEN A Correlation III "A" Correlation III "C" Correlation	- 200 + LITHOLOGY	Induction Resistivity Induction Conductivity of the state	2" Normal		OLOGIC A G E
2 4 6 8 10 12 14 Q Q Q S 10 15 20 30 40 50 70 X X X X X X X X X X X X X X X X X X		7 16			LI1
12½" 12½" 0cc P 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0 0	RUN 2	RUN 2 3	RUN 1	2540-3274' SHALE Light to medium grey, generally stightly to moderately	
D-19 D-19			V	carbonaceous, often slightly pyritic, in part micaceous, predominantly non — silty but includes several moderately silty zones, very slightly fossiliferous, platy to fissile. Several interbeds of very argillaceous, carbonaceous	
У— оsc-3	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\		and they they they	Siltstone occur in the lower part of the unit. Ironstone is common near the base of the unit and is present in minor amounts throughout the remainder of the unit.	
2700 + + + = = = = = = = = = = = = = = = =			V and		
					S
C-3 HTC SFCH D-19 RR C-4 Mindrill Dip ? Rec. 8' Dip ? Dip O-59					
\\ \\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\					
			nd brancher		
Granges TT	9				
			the state of the s		
3100 Tr. Ø					
D-21					ν
Granges T T C-5 Mindrill ♦ Dip Dip					
D-22 Granges D-22 Granges D-22 Granges				3274—3302' SANDSTONE and SILTSTONE Sandstone: white, light grey and brown, very fine to fine grained, subrout to subangular quartz, calcareous to siliceous cement, in part with	
T. O. 64 mins. S. I. 35 8 43 mins. Rec. 5' mud.			The state of the s	earthy porosity. <u>Siltstone</u> medium grey, slightly sandy, slightly carbonaceous, moderately to very argillaceous.	
1.H.P. 1657 F.H.P. 1657 1.SI.P. 127 F.S.I.P. 27 1.F.P. 23 F.F.P. 24				3302-3418' Interbedded SHALE, SANDSTONE and SILTSTONE Shale: medium grey, in part olive grey, carbonaceous, slightly silty, sub-fissi Sandstone: (upper part of unit) white to medium grey, very fine to fine grained, angular to subangular quartz, in part carbonaceous, commonly	ile. LLJ
D-23 Granges Granges			A A A A L	moderately calcareous, in part with earthy porosity. <u>Siltstone:</u> (Lower part of unit) medium grey, moderately carbonaceous, very argillaceous, in part slightly sandy.	
D. S. T. No. 4 3504 – 3573'			of European Conference of Conf	3418-3506' SHALE Medium light to medium grey, very slightly silty and micaceous, moderately to very carbonaceous near the base of unit, sub-fissile. At base of unit 30% Shale: dark greenish grey, waxy to very carbonaceous.	Z
T.O. 120 mins. S.I. 69 8 30 mins. Rec. 190' mud 1,H.P. 1831 F.H.P. 1820 1,S.I. 1, S.I. 1,			Co.	3506-3539' Interbedded SANDSTONE and SHALE (15%). Sandstone: light grey, very fine to fine grained, quartz, slightly silty, kaolinitic, poor earthy and intergranular porosity.	
D-25	**************************************			Shale: medium to dark grey, slightly carbonaceous and silty. 3539-3692' SHALE with minor interbedded SANDSTONE Shale: medium grey to greenish grey, slightly carbonaceous and silty, in part slightly sandy, chunky to sub-fissile.	
Granges MD Cc o				<u>Sandstone:</u> white to light grey, very fine to fine grained, subangular to subround quartz, moderately to very silty and calcareous, some earthy porosity. At 3562-3568' <u>Pebbly Sandstone:</u> medium tovery coarse, round to angular quartz grains, chert and lithic fragments in matrix of fine	
D-26 Granges Granges	\$			angular quartz grains, chert and lithic fragments in matrix of fine to medium grained sandstone. Ironstone is common in the upper part of the unit. 3692-3770' SHALE	S CO
MD Tr.P			A Paragraphic Control of the Control	Medium light to medium dark grey, in part greenish and brownish grey, slightly micaceous, very slightly carbonaceous, fissile to sub-fissile. 3770-3928' SHALE	z
3800 + + +			Assistant Assist	Medium light to medium dark grey, in part olive and brownish grey, in part slightly calcareous, commonly slightly silty and micaceous, rarely slightly sandy, fissile to subfissile. Occasional crinoid stem fragments from 3810' onwards;	
D-27 Granges				Ironstone common near base of unit and scattered throughout remainder of unit; several interbeds of sandy and very argillaceous Siltstone occur near base of unit.	4 4
OWV-J 3900 + +	0 0 0			3928-4090' Interbedded SHALE and SANDSTONE (40%). Shale: medium to dark grey and greenish grey, rarely brown and black,	
C-5 RR Mindrill \$\rightarrow\$ D-28 Granges MD D-29 C-5 RR Mindrill \$\rightarrow\$ Pip Trop Trop	Fg'''-''-''-'-'-'''			occasionally slightly silty, sub-fissile to blocky. <u>Sandstone:</u> light grey, very fine to fine grained, angular to sub-angular quartz, slightly to moderately calcareous, often siliceous, rarely kaolinitic, tight.	. o O
Granges TDS D-30 Granges Tro Occ. #				Uppermost members of unit consist of very ferruginous sandy siltstone and silty sandstone.	
Granges - D-S - 1½ - 1½ - 1½				4090-4310' SHALE and SILTSTONE (15%).	-
D-31 Globe MHV3	5 6 5 5			Shale: medium light to medium dark grey, in part slightly to moderately silty, in part carbonaceous, occasionally slightly calcareous, chunky to blocky; occasional plant remains. Siltstone: grey to brown, in part moderately to very argillaceous,	
D-32				in part siliceous, slighly calcareous, in part sandy. Occasional interbed of siliceous and/or argillaceous, very fine grained sandstone.	
Granges TT Granges TT Granges TT Granges Gr			took the last	Common Ironstone.	_
4300 4300 GC.69 Tr.O				\$310-4438' SHALE Medium light to medium dark grey, slightly sandy (medium to very	
D-33 Granges TT				coarse quartz grains), commonly slightly silty and carbonaceous, fissile to chunky; in upper part of the unit the shale is slightly fossiliferous (gastropods, crinoid fragments).	 - œ
D.S.T. No. 5 4527 - 4557'				Occasional interbeds of very fine grained to fine grained Sandstone. 4438-4457' SANDSTONE White, very fine to fine grained, subangular quartz, moderately to very	
T.O. 98 mins. S.I. 49 & 53 mins. Rec. 250' w.: mud and 2855' sat water.				calcareous, moderately carbonaceous, slightly silty, tight. 4457-4541' SHALE Medium light to medium grey, slightly to moderately silty, moderately	≥Ш
OWV IH.P. 2452 F.H.P. 2447				carbonaceous, chunky to sub-fissile; with common <u>Shale</u> : variegated (olive, yellowish brown, buff, black), non-silty, lath like. Occasional interbeds of grey, brown and green Siltstone and grey to brownish and greenish grey, very fine to fine grained Sandstone.	
D-36 D-37 D-37 D-38				SANDSTONE Grey to light brown, predominantly fine grained (very poorly sorted with grain size variable from very fine to granule sized), angular to sub-angular quartz and rare lithic grains, dolomitic to calcareous carbonate cement, in part sticeous, medium integranular parceity.	>
T T T G. 68 mins., S.I 10 8 28 mins. : G.T.S. 2 mins. T S T N, increased to maximum I-54 MNcf/day in 60 mins. Rec. IO' g.t. mud			Association of the state of the	sfliceous, medium intergranular porosity. 3564-4630 SHALE Medium light to medium grey, slightly carbonaceous, rarely slightly silty, soft, waxy, fissile to sub-fissile.	
D-37 Granges TT	1			Medium light to dark grey, carbonaceous, slightly waxy, platy to blocky. Common interbedded argillaceous Siltstone and some fine grained Sandstone. R716-4726' SANDSTONE	
D-38 Granges TT C-5 RR Mindrill ♦ D-39 HT C DS T. Nb.14 4694 - 4760 T.O. 120 & 150 mins. S.1. 60 & 120 mins. GTS. 5 mins T.S.T.M increased to maximum increased to maximum				White, fine to very coarse grained, angular to subround quartz, slightly calcareous to dolomitic, very poorly sorted, very friable, medium to good inter granular porosity; grades to tight Sandstone with abundant dolomite cement.	
OWC 10 / 1-15 MMc f/day in 130 17 1-15 mins. Rec. 135' mud. 1-15 mins. Rec.		RUN 3	RUN 2	A726-4833' Interbedded SHALE, SANDSTONE, and SILTSTONE Shale: medium grey and greenish grey, slightly carbonaceous and waxy, platy. Sandstone: white to grey, very fine to fine grained, calcareous and silty. Siltstone: grey and greyish green, in part argillaceous, very finely sandy.	
D-40 HTC OWC 1st LFP 87 1st EFR 222 1st EFR 222 1st EFR 222 1st EFR 224 1	RUN 4			#833-4860' SANDSTONE White to light grey and brown, very fine to fine grained, subangular quartz; grades to <u>Sandstone</u> : white, predominantly medium to coarse grained, angular to subround quartz, very friable, good intergranular porosity.	
D-41 HTC OWC D.S. T. No. 7 4761 — 4888'				860-4950' SHALE Medium to dark grey, in part silty and sandy (fine to coarse quartz grains), sub-fissile to chunky.	
C-5 RR Mindrill 0 II T. O. 90 mins. S.I.20 & 33 mins Rec. 800' w.c.mud 82719' muddy salt water. 2 LH.P. 2693 F.H.P. 2681 Rec. I. S.I.P. 1920 F.S.I.P. 1920		3 (4,7)		At 4920-4926' <u>Sandstone</u> : light grey, very fine grained quartz, moderately silty and calcareous, in part siliceous. Several interbeds of argillaceous and/or sandy Siltstone. Ironstone common near top and base of unit	
Tr. Ø 1.51P. 1920 FSIP 1909 1.FP. 488 F.FP 1643 1.FP. 488 F.FP 1643				Ironstone common near top and base of unit.	

COMPOSITE WELL LOG ALLIANCE BONAPARTE WELL No.2

5000 - 7008' Sheet 3 of 3

										Sheet	- 7008' 3 of 3								
		GS 1 Dips			DIPMETER RES	1 1 1	e e	GRAIN SIZE	POTENTIAL		RESISTIVITY Ohms - m²/m	OI	SISTIVITY hms - m²/ m		RESISTIVITY Ohms — m²/ m			STRATIG COLU	
BIT TYPE and REMARKS	DRILLING RATE Min./ft.	and PLU	FORMATION TESTS	GAS DETECTOR	W - CO E Arrows denote direction Correlation Grad Interval Correla	on of dip B DEPTH le and S feet	Y Dub LITHOLOG	(Average for	(15)	INTERPRETED LITHOLOGY	o 18" Normal	500 O	6' Lateral 50 500	CALIPER	I·5" Lateral		LITHOLOGIC DESCRIPTION	FIND	
REMARKS		DEV CASING			III "A" Correlation III "B" Correlation III "C" Correlation II "D" Correlation MAGNITUDE OF DIP	OCARE	Perce	fine b lum	- 		o Induction Resistivity	_ 50 500	mhos m²/ m	Hole Diameter in Inches	2" Normal	40		HOLOGIC	A. G. E
	2 4 6 8 10 12 14	S			0 5 10 15 20 30 40	ANGLE 10 150 70 90 X		Silt Very Fine Medi		-11-				7 16	6 National Association of the Control of the Contro	4950'- 5548'	SHALE	Ë	
						NAME OF THE PROPERTY OF THE PR		& Occ. o					3		the state of the s		Medium light to medium dark grey, slightly to moderately carbonaceous, in part slightly silty, in part slightly sandy, rarely slightly calcareous, generally slightly fossiliferous but very fossiliferous from 5100 to 5200 feet, fissile to platy. Occasional Ironstone.		
D - 42 H T C OW C	}					5100		ο)			Marining Charles		occusional monstone.	S	
	\	12				5200		g				}	C.T.	\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\\	A Company of the Comp				
	}				-	5200	9	P		9	Sales of the sales			JAMM	W. william V. V. Tild			0	
D-43 HTC OWC						5300		F 0 0 0							H. M. Artinian Control of the Contro				:
							**************************************	Tr Ø							so recognized by the second se			Ш	S
C-4 RR Mindrill ♦	<u> </u>	2° 12 Dip 2°			# +	5400		Occ P P CO Tr Ø		•							At 5366 — 5374' <u>Sandstone</u> : white, fine to coarse grained, angular to subangular quartz, poorly sorted, siliceous, very slighly porous At 5390 — 5402' <u>Siltstone</u> : medium grey, siliceous, slighty argillaceous, coarse and grades to Sandstone)
D-44 HTC		Rec 10' 6']	F 0 C Tr. g		0					Archard Appendix			8	0
owv \						5500	<u> </u>			0 N				WWW WWW		5548-5560'	SANDSTONE		四
D-45 HTC OWV	_	72			A A	Fi	e \$	Tr 0		s'.'-'.'.'.					The state of the s		Buff, very fine to fine grained, angular to subangular quartz, well sorted, siliceous, some brown argillaceous cement, slightly calcareous, good earthy porosity, trace intergranular porosity.		ഥ
D-46 HTC OWC		/ ₂	D. S. T. No.12			5600	ex S C	Dec. P		••S',',',',',C						5560 - 5609' 5609-5628'	SHALE Medium light to medium grey, slightly to moderately silty, platy to blocky; with occasional argillaceous and/or siliceous Siltstone. SILTSTONE grading to SANDSTONE. Siltstone: light grey, argillaceous, micaceous and siliceous; grades to		-
D-47 HTC OWC		2/2	5706 — 5728' Misrun			5700		C Tr. 60								5628-5704	<u>Sandstone</u> : white to light grey, very fine to fine grained, subangular to subround quartz, siliceous, carbonaceous, very slightly porous.		z
D-48 HTC OWC D-49	<u> </u>	y ₂ ° \	D.S. T. No.13 5713 - 5735' T.O. 60 & 120 mins. S.I. 60 & 60 mins.				e	F Tr. P Ø				\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \				5704-5765'	Sandstone white, very fine to fine grained, tight. SANDSTONE White, very fine to fine grained (some medium to coarse grains), subangular quartz, generally siliceous and tight but porous in interval 5726 – 5736.	S	0
HTC W7	\ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \ \	• / /	Rec. 430' salt water i.H.P. 3266 1st i.F.P. 23 1st F.F.P. 104		1 3	5800	; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ; ;	Pr. 9		V V			T T = - -	May		5765-5892'	Near base the unit includes <u>Shale</u> : medium grey, very slightly silty, platy. SHALE, SANDSTONE and SILTSTONE <u>Shale</u> : medium to dark grey, in part black, slightly silty, fissile to lathlike.		В
D-51		24	ISIP 2176 2 nd I.FP 108 2 nd F.FP 254 F.S.IP 2113				:	Tir Ø		0,2,2,1,1,0,1,1,1	, man			Man Man		5000 5004	<u>Sandstone</u> : white to light grey, very fine to fine grained quartz, in part silty, in part argillaceous, tight, <u>Siltstone</u> : light to medium grey, argillaceous and/or siliceous.	Z	1 R
D-52 HTC W7	4 8 12 16 20 24 28 CHANGE SCALE		FH.P 3048	: 		5900	\$	⊙Tr.P P _Q ⊙ Occ _Ø		8 9					to Control of the Con	5892-5984'	SHALE and SANDSTONE (30%). Shale: medium to dark grey, moderately silty, slightly to moderately sandy, platy to blocky. Sandstone: very light grey, very fine to fine grained, angular to	4	7)
C-4 RR Mindrill ♦	2 44 6 8 10 12 14	13 Dip 2-4°	•				e	C Tr Ø Tr. P Doc. Ø								5984-6053'	subangular quartz, in part silty, in part carbonaceous, tight. SHALE Medium to medium dark grey, in part greenish grey, slightly to		
HTC OWC D-54	CHANGE SCALE	Rec. 12'	<u>D. S. T. No. II</u> 6058 — 6180'			6000	S	9,0ccР Ф ф Ф		11 11 11 11 11 11 11 11 11 11 11 11 11	C. C					6053-6106'	moderately silty, in part slightly sandy, platy to chunky; occasional Siltstone and Sandstone. SANDSTONE	b ၂၀	
HTC OWV		2° \	T 0. 90 8 210 mins. S 1. 60 8 60 mins. Rec. 400' w.c. mud and		*	FI 6100	e (Πr Ø ,P								6106-6156	White, fine to medium grained (some coarse to very coarse grains), angular to subangular quartz, siliceous, slightly porous. SHALE and SILTSTONE Shale medium grey, in part olive, brownish and greenish grey, slightly		
D-56 HTC	180 160 155 [2½	1.H.P. 3268 st F.P. 27 st F.F.P. 240 ISI.P. 2410		*		e e e e e e e e e e e e e e e e e e e	6 ∞ C,0cc6					7			6 56-6200'	micaceous, waxy, slightly sılty, sub-fissile to chunky. <u>Siltstone:</u> light to medium grey, slightly argıllaceous, coarse, sıliceous. SANDSTONE	-	<u>م</u>
OWC-J D-57 HTC W7 D-58 HTC W7R	170	2° / }	2 nd FFP 251 2 nd FFP 552 FSJP 2385 FHP 3168			6200	V	Θ Dec. Θ		" V		7		\(\frac{1}{2}\)		6200-63741	White to light grey, fine to medium grained (some very fine and coarse grains), angular to subangular quartz, in part silty, siliceous, slightly porous. SHALE and SANDSTONE (20%) Shale: medium to dark grey, in part olive and greenish grey, slightly		Ш
D-59 HTC W7R								F 8		1			1	WW.			silty, in part slightly sandy, platy to blocky. Sandstone: white to light grey, very fine to fine grained, occasional medium grains, angular to subangular quartz, in part silty, in part silceous, rarely with abundant carbonate cement		≯
HTC W7R						6300		5,Tr. <i>6</i>						T M Cany La			Occasional argillaceous and siliceous Siltstone.		
D-6I HTC OWV	169	31/4				C400		Ø F C,P,Ø Occ.Ø	[Part 12 11 11 11						6374-6420'	SHALE and SILTSTONE (30%). Shale medium to dark grey, slightly silty, in part sandy, chunky. Siltstone: light grey, in part argillaceous, in part sandy, commonly		
D-62 HTC OWC-J	7		D. S. T. No. 8 6 4 41 - 6527 ' T. O. 61 mins. S. I. 18 8 21 mins.			6400	s s s	Tr. Ø		10 10 20 10 20 10	A MANANA A			A Company		6420~6460'	very siliceous, rarely carbonaceous SHALE Medium to dark grey, rarely sandy, platy to chunky.	-	
D-63 HTC W7R	150	3°	Rec. 652' mud I.H.P. 3606 FHP 3603 I.S.I.P. 2574 FSIP 2434 I.F.P. 396 FEP 2375	3 3 4 5	* * * * * * * * * * * * * * * * * * * *	6500	e S :		RUN 4	a	RUN				RUN	6460-6496'	SANDSTONE and SHALE (40%). <u>Sandstone:</u> white to light grey and greyish green, very fine to fine grained, moderately to very silty, siliceous, tight. <u>Shale:</u> as at 6420-6460'.		
С-6 НТС НЕСН	150	14 Dip 5 - 12 Rec.					, , , , , , , , , , , , , , , , , , ,	6	RUN 5	G				TWAM AM		6496~6675'	SHALE Medium to dark grey, in part olive green and brown, in part slightly silty, occasionally slightly sandy, commonly slightly carbonaceous, rarely calcareous, platy to chunky.	Σ	
D-64 HTC		105				6600		Occ. 6 8	<u> </u>	"	3-			The state of the s					
W7R		20	<u>D.S.T. No.9</u> 6709 – 6804' Misrun					Tr. 9		11 11 11 11 11 11 11 11 11 11 11 11 11					Mining William Control of the Contro	6675 - 6733'	SHALE and SANDSTONE Shale: dark grey, slightly micaceous, platy to chunky. Sandstone: light grey and brownish grey, very fine to fine grained,	~~~~	
D-65 HTC W7			D.S.T. No. 10 6727 – 6849'			6700	e to the second									6733-6750	silty, siliceous, in part calcareous, tight. SANDSTONE Light grey, very fine to fine grained (some medium and coarse grains),		S TO
D-66 HTC		2°	T. O. 75 mins. S.L 32 & 30 mins. Rec. 150' mud 1.H.P. 3977				1	60								6750-6 8 09'	angular to subangular quartz, moderately silty and siliceous, fair earthy porosity and trace intergranular porosity. SHALE	10	N N
W7R D-67 HTC W7R			FHP 3922 ISLP 872 FSLP 981 IFP 123			6800	e	0		00			>			6809-6876'	Dark grey, in part olive and brownish grey, chunky; with some interbedded fine grained, siliceous Sandstone SANDSTONE and SHALE (40%) <u>Sandstone:</u> light grey to brownish grey, very fine to fine grained,	IGE FORMA	BONIF
D-68 HTC	150	14	F.F.P. 151			6900	\$ = = = = = = = = = = = = = = = = = = =			······································			MAN .	1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1			angular to subangular quartz, poorly sorted with medium grains, silty kaolinitic and siliceous cement, in part slightly calcareous, tight. Shale: dark grey, in slight part silty, sub-fissile to blocky.	AA	CARE
W7R D-69								⊙ Tr. <i>g</i>		11				V-V-COUP OF		6876'-7008'	SHALE Medium tomedium dark grey, slightly micaceous, in part slightly silty, rarely sandy, sub-fissile to blocky; with	URT R	WER
HTC W7R C-7 HTC HFCH	244)°			0 5 10 15 20 30 40	7000				\$ 11 mm 1 mm							several interbeds of very fine to fine grained, calcareous Sandstoine; rare stringers of sandy Limestone.	m	L OV
HIC HECK		Djp Rec. I' 9"			True North														
			<u></u>	<u> </u>	Arrows denote direction	on of dip												<u></u>	