9229-F9-4E

Report on the Reflection Seismograph Survey at DAHADINNI, N.W.T. 62°10'-63°40'N, 124°15'-125°W

for

Forward Resources Ltd.

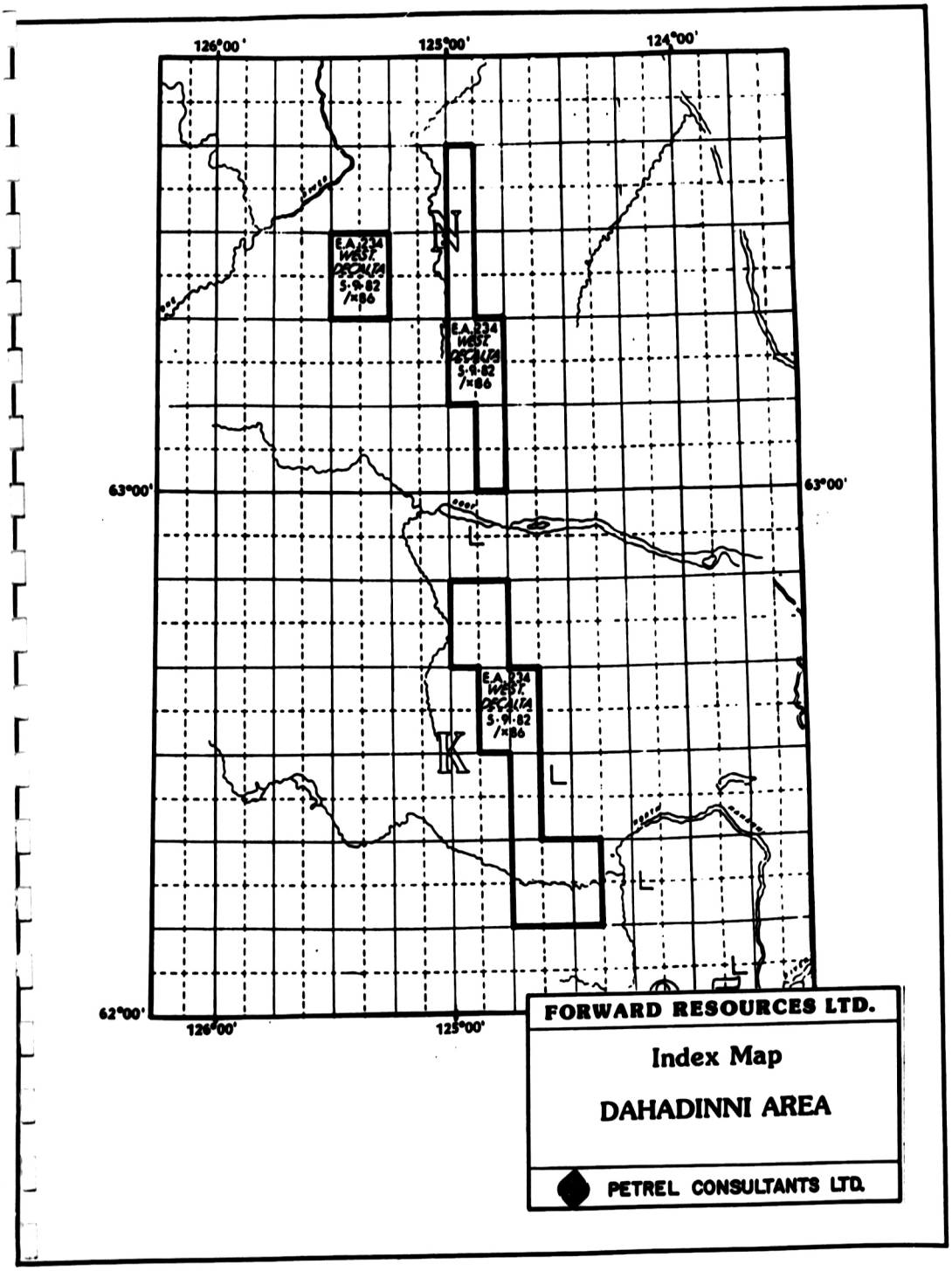
by

Petrel Consultants Ltd.

November 1983

Land Use No. N83-B913
C.O.G.L.A. Program No. 9229-F9-4E

J.D.T. Crane



FORWARD RESOURCES LTD.

Index Map

DAHADINNI AREA

PETREL CONSULTANTS LTD.

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DAHADINNI

Introduction

Forward Resources Ltd. obtained a farmin of 437,890 acres in the Dahadinni area, N.W.T. from Esso Resources Ltd. During the summer of 1983 Forward conducted a 213 km. portable seismic survey over the lands in order to provide a basis for drilling in 1984. To supplement these data a study of the surface geology was undertaken during late August 1983. The following report summarizes the results of these surveys.

Seismic Data

A seismic program of 18 lines of 600% CDP dynamite shooting was conducted for Forward Resources Ltd. by Pacer Geophysical. These lines are parallel and were positioned at right angles to the mountain front structure and thrust faults.

The quality is extremely poor. Recording in the mountainous terrain using portable drills and 16 meter tamped holes yielded very noisy data which suffered from sideswipe and discontinous reflectors. Increasing the dynamite charge from 10 to 20 kg on lines 10 and 13 to 18 did not improve the quality. In the plains east of the Iverson thrust, quality was fair to good due in large part to the flat topography and a softer near surface material in which the shot charges were placed.

Regional Geology

The farmin area lies on the eastern edge of the MacKenzie mountains straddling the Iverson Range. The Trench Lake Syncline to the west and the English Chief anticline to the east are prominent structural features as are the Iverson and Dahadinni thrust faults, along which the Iverson Range was uplifted.

To the east, in the MacKenzie plain, surface outcrops of Trout River, upper Devonian clastics occur, immediately underlain by the thick Fort Simpson shales. Underlying this is the regional sequence of middle and

lower Devonian carbonates of the Nahanni to Camsel formations. Siluro-Ordovician carbonates and anhydrites overly Cambrian Sands and Proterozoic metasediments.

Uplifted formations found west of the thrust fault are the mountain building units of the middle and lower Devonian carbonates. The Arnica, Sombre, Camsel and Delorme Carbonates found in the South part of the area give way in the north to the Bear Rock anhydrite which forms an extensive section tested by the Dahadinni 1-70 well. To the south and west of the carbonates the major Funeral Shale basin is present. Possibilities for reef growth in the section extending upwards from the Ronning to the Lower Devonian exist in the area.

The main prospective zones include carbonate porosity in structures paralleling the Iverson thrust. Secondary prospects such as Ronning reef developments and minor imbricated structures are considered.

Interpretation

The nearest well control is provided by the I.O.E. Dahadinni I-70 and Texas Iverson M-69 wells both located off the seismic lines. Identification was made utilizing tops from the M-69 well relative to the east end of line 6. A sonic log (penetrating to the Arnica) enabled the Nahanni to be identified, shown in green on the sections. Regional thicknesses taken from the Root River geology map, no. 1376A, together with estimated velocities provided a basis for tentative identification of Ronning, Cambrian and Pre-Cambrian events. The marked quality deterioration west of the thrust fault precluded the correlation of these events.

The surface trace of Iverson thrust was noted on the sections and using some sporadic, divergent dips the fault plane was interpreted as dipping to the west, commencing at about 15-20°. The enclosed map illustrates this fault plane surface in time.

The major reflector (Nahanni - green) was not present on the sections west of the fault due to the structure which uplifted it to an outcrop position. The regional Nahanni sheet has been interpreted but due to poor quality, velocity uplift effects and its depth the map which was prepared is of limited value.

Under the Northern acreage block quality was better and a correlatable reflector, within the lower Devonian, was mapped. Both NE and SW dip is shown and some indication of plunge to the Southeast is suggested on the map. This structure is believed to be the southward extension of the one tested by the Dahadinni I-70 well which bottomed in the Bear Rock anhydrite after drilling through some faults. No hydrocarbon shows or tests were found at I-70 and more information would be needed to evaluate this structure.

Maps prepared from seismic data include:

South Area - Iverson thrust plane in time
- Form lines of Iverson structure
- Nahanni structure on regional sheet

North Area - Lower Devonian Marker, Time Structure

The main area of interest (south area) is the doubly plunging anticline extending over about 18 miles west of and parallel to the Iverson Thrust. The oldest, uplifted outcrop shown on the structure is the Lower Devonian, Sombre. It would be desirable to test the feature at a point where the older, Ronning, formation is present on the uplifted sheet. The surface geological evidence as shown on the enclosed report by Peter Jones indicates that the thrust angle is quite shallow and the uplifting of beds below the Camsel is in doubt. Some seismic evidence exists for the thrust to be deeper and possibly some Siluro-ordovician formations would be encountered before the well re-enter the regional sheet.

Conclusions and Recommendations

The doubly plunging Iverson structure uplifted by the main frontal thrust is considered to be the best prospect under the acreage. Both surface geology and the seismic data, admittedly poor in quality, indicate a test well to 6000 feet should be drilled on this feature.

This should be J-66, 100 meters Northwest of shot point 373 on line 8. Co-ordinates of this are 62°35'40"N, 124°41', 35"W.

The final selection of a drill site should be based on topographical considerations, suggested to be on a small flat, shore line bar along the English Chief River.

Prognosed depths at this location are difficult to determine and these given in Peter Jones' report, attached, can be used although some seismic evidence suggests the tops could be deeper.

APPENDIX A

FIELD PARAMETERS

AREA: DAHADINNI, N.W.T.

Recording

Sample Rate	2 milli-seconds
Record Length	#7 & #9 - 3 seconds/balance 5 seconds
Recording Filter	12-128 Hz
Sub-surface Coverage	600%
Number of Groups	96 trace
Group Interval	25 metres
Shot Point Interval	200 metres
Geophone Array	9 at 2.8 m
Seismometers per Group	9
Spread	1200-25-0-25-1200 m split
Holes per Location	One
Hole Depth	16 metres
Dynamite Charge	10 kg. Geogel - Lines 1-9, 11, 12 20 kg. Geogel - Lines 10, 13-18

APPENDIX B

STATISTICAL DATA

Dates:

Mobilization Date:	June 4, 1983 - Constructing Airstrip etc.
Start of Drilling:	June 15, 1983 - Move, June 21 - 1st Holes
Start of Recording:	July 1, 1983 - Move, July 3 - 1st Shots
Completion of Recording:	September 6, 1983
Demobilization Date:	September 7/8 1983

PRODUCTION

Recording

Total operating days:	97 days
Total recording days:	63
Total moving days:	2
Total weather days:	7
Total testing days:	Ø
Total down days:	Ø
Kilometres shot:	213.425 km
Kilometres per production day:	3.38 km Average
Total days moving mob/demob:	16 days - Camp left in place.

APPENDIX C

EQUIPMENT AND PERSONNEL

Technical

Amplifiers	Texas Instruments DFS V
Camera	SIE ERC-10
Remote firing system	Input Output Encoder Decoder #200WT and 1978 & Rota-A-Long
Cables	Seismic Cable Service - 465' - 58' Intervals
Geophone Strings	Mark Products Ltd. - L28D - 14 Hz 710 OHM Coil 9 per string

Vehicles

Number	Use
1	Recorder
6	Drilling Rigs

Portable Crew with Equipment

Portable Doghouse moved by Helicopter
Modified Canterra Heliportable
Seismic Air Drill Rigs - 3
Tri Airmotive Ltd. - Twin Otter - F-10-K

Portable Crew con't.

Okanagan Helicopters - 214 - Trailers - Cats - Fuel - Etc.
Buffalo Airways - Gazelle - Recording Crew

WEA Kenting Helicopters - 206B	Move Rigs to camp and on program
WRD Kenting Helicopters - 206	Program
	Move Rigs
TTM Tri Airmotive Ltd. - 212	Recording Crew - Surveyors - Line
AHY Tri Airmotive Ltd. - 204	Cutters - Fuel Barrels

Number	Use	
1	Expediter Truck	1979 Ford F250 4 X 4
3	Powder Magazine	2 - Wheeled Magazines
		1 - 8 X 18 Skid Magazine
1	Incinerator	

8 Unit Kitchen - Diner - Utility - Complex for 70 men
4 - 50 KW Generators
6 Unit - Sleeper - Washroom Office Complex - 70 men
5 Unit - Sleeper - Washroom
3 - 500 Gallon Fuel Tanks for Generators

Dozer Crews

Vehicles

1	Bob Cat	Haul - Supplies runway to camp
1	Kamatsu D31 Cat	Clean Site - Runway Drag Airstrip

Fuel Haul Camp

1 Kitchen - Diner - Sleeper - Power Unit Sleigh mounted.

Fuel for drills and helicopters and cats stored
in 6-500 gallon steel drums in camp
Drums stored in berm at site

REPORT OF GEOLOGICAL FIELD WORK IN SOUTH DAHADINNI AREA, N.W.T. WITH RECOMMENDATIONS FOR LOCATION OF A TEST WELL

by

PETER B. JONES, P. GEOL.

COPY #6

REPORT ON GEOLOGICAL FIELD WORK IN THE SOUTH DAHADINNI AREA, N.W.T., WITH RECOMMENDATIONS FOR LOCATION OF A WELL TO TEST THE LOWER DEVONIAN CAMSELL FORMATION.

INTRODUCTION

Geological field work was carried out in the South Dahadinni area, Northwest Territories in conjunction with seismic exploration. The area lies in mountainous terrain west of the Iverson fault, which extends for over 150 km in a north-south direction. Geological cross-sections published by the G.S.C. implied that the Iverson fault dipped steeply westward at such an angle that it would underlie the Forward-interest acreage at a depth of several kilometres, uplifting the potential reservoir sequence. The seismic work was expected to confirm this and define the overlying structure more accurately but, owing to poor records neither the Iverson fault nor the overlying structure could be clearly delineated by geophysics. At this point the writer became involved and spent four days in the area, mapping the surface geology with particular emphasis on the Iverson and any other faults that might exist. Using a helicopter, the writer examined the surface trace of the Iverson fault over a distance of 85 kilometers from north to south, and checked the geology of about 2,000 square kms on both sides of the fault, looking for evidence of the dip of the fault, both at outcrop and in the subsurface. A description of the results follows, illustrated by a geological map, (Figure 1), eight cross-sections, (Figure 2A through H), a structure contour map of the top of the Devonian Camsell Formation, Figure 3, and a well location with prognosis.

RESULTS

The Iverson fault is exposed in one or two localities, where it proved possible to measure its dip directly. Elsewhere, although not exposed, the surface trace of the fault could be followed well enough that its attitude could be determined by simple three-point calculations. A number of measurements and calculations were made giving consistent values of west dips in the 16 to 19 degree range. In terms of relative dips, this means about 13° relative to the underlying Upper Devonian Fort Simpson Formation, 3-5° relative to the overlying Lower Devonian Sombre Formation. Thus the Iverson Fault is a low-angle thrust having an absolute minimum of 7.5 km of horizontal displacement, 13 to 20 km being a more realistic figure.

These low angles mean that the thrust lies at a very shallow depth throughout the acreage to be earned, and any well would encounter the thrust before it reached the Ordovician - Silurian Ronning Group, original target of the proposed well. The most reasonable alternative objective above the thrust is the Lower Devonian Camsell Formation, lateral equivalent of the Bear Rock which was penetrated by the Imperial Dahadinni 1-70 well, 80 km to the north. The area lies in the transition between the evaporite of the Bear Rock and the carbonate-shale sequence to the south. The Camsell reflects this in its lithology, which includes both evaporites and limestones. It is felt that there is a good chance that some, if not all, of the Camsell Formation, possibly thickened by thrusting, overlies the Iverson thrust fault, at the location proposed. The Camsell Formation is exposed on the west flank of the Trench Creek syncline, west of the acreage, where it is about 230 metres thick, comprising a mixture of interbedded evaporite, breccia and limestone.

Because of the evaporite, the Camsell is a natural locus for faults. In the cross-sections, the Iverson thrust has been shown following the base of the Camsell for some distance across strike. It is possible that sections of the Delorme Formation, siltstones, shales and limestones, underlies the Camsell, but this is unlikely.

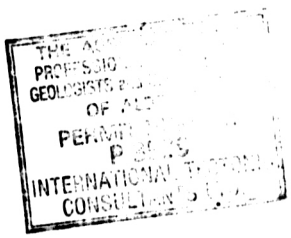
The Ronning (Whittaker Fm in the map-area) is of course present in the Forward-interest acreage, but beneath the Iverson thrust, well beyond the reach of a 6,000 foot or even a 10,000 foot test and, in any event, would have no structural closure.

Beneath the thrust, capped by the Fort Simpson Shale, the undisturbed Lower Devonian and older sequence of carbonates dips gently westward. As far as this sequence is concerned, there is no structural advantage to the I-66 location.

At the location proposed (I-66), the thrust should be encountered at a depth of about 440 metres (1,445 feet), beneath which further drilling should penetrate black shale of the Fort Simpson Formation, encountering the Nahanni-Headless limestone at 1,740 m beneath which is a continuous section of dolomites and limestones including the Camsell, whose top lies at about - 2,100 m subsea. In the event that some Delorme does underlie the Camsell in the hanging wall, the thrust may be as deep as 900 m below K.B., but this also is unlikely.

A surface geological map accompanies this report. It is based on G.S.C. mapping supplemented by the writer's observations. Eight cross-sections have been drawn across the area studied (Figure 2A through H). The structure contour map, Figure 3, was prepared from the cross sections. The location of the I-66 well in relation to the structure of the Camsell Formation is indicated by the structure contour map. The location was felt to be a reasonable balance between best geological location, (i.e.) highest part of structure, and ease of access and drilling. It is well within the limits of closure of the structure. Closure is provided both by the folding and by the cutoff on the east against the Iverson thrust. Fort Simpson shales beneath the thrust could act as both seal and source rocks. Results from the well should be definitive for the overthrust Camsell Formation in the entire South Dahadinni acreage block.

A well prognosis, based on the I-66 location follows.



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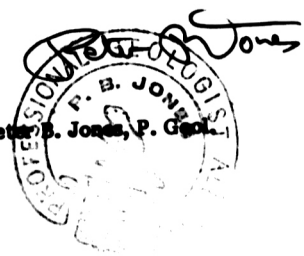

Peter B. Jones, P. Geol.

WELL PROGNOSIS

Forward et al South Dahadinni I-66

K.B. elevation	**614 m (2,015 ft.)**
Spud in river gravel	**Depths below K.B.**
Lower Devonian, Sombre Formation	**35 m (115 ft.)**
Dolomite and limestone, cryptocrystalline to fine grained, fossil fragments.	
L. Devonian, Camsell Formation (Bear Rock equivalent)	**80 m (230 ft.)**
Dolomite, limestone, evaporite and breccia, probably contorted and thickened by faulting.	
Thrust fault/U. Devonian, Fort Simpson Formation	**440 m (1,445 ft.)**
Shale and mudstone, limestone stringers, scattered nodules, brachiopod coquina at 1,965 m.	
Middle Devonian, Nahanni Formation/Headless Limestone	**1,740 m (5,170 ft.)**
Fine to medium grained-limestone.	
M. Devonian, Landry Formation	**approx. 2,070 m (6,790 ft.)**
Cryptocrystalline to medium-grained grey limestone.	
M. Devonian, Arnica Formation	**approx. 2,270 m (7,448 ft.)**
Dolomite, dark grey-brown, microcrystalline to fine-grained recrystallized fossils.	
L. Devonian, Sombre Formation	**2,250 m (8,367 ft.)**
L. Devonian, Camsell Formation	**2,800 m (9,187 ft.)**