9229-F9-1

REPORT ON THE

SEISMIC EVALUATION OF THE COLVILLE HILLS AREA OF THE N.W.T.

66° - 68°N, 123° - 125°W

9229-F9-1E

For

FORWARD RESOURCES LIMITED

By

PETREL CONSULTANTS LTD.

J.D.T. Crane

P. Viney

August 1982

PROJECT ACTION SHEET

RESOURCE EVALUATION BRANCH

PROJECT NUMBER: 9229-F9-1E

COMPANY: Forward Resources

REPORT TITLE: Seismic Evaluation Colville Hills

The following action has been taken:

Receipt acknowledged .....

Reports and maps date-stamped .....

Memo sent to Land Management.....

Reports for review list edited .....

Inventory sheet made .....X.....

REVIEW AND APPROVAL made by:

DCW Dec 21/82

COMMENTS:

Introduction

The Colville Hills prospect of the N.W.T. lies north of Great Slave Lake between 66° - 68°N and 123° - 125°W. A farmout was taken on 600,000 hectares of land by Forward Resources Ltd. from Esso Resources and seismic data was accumulated and studied in preparation for exploratory drilling to be undertaken in 1982 and 1983.

The initial work involved the evaluation of 950 km of seismic data provided by Esso Resources while the new work was comprised of 300 km of seismic data shot by Forward Resources during February - March 1982. Reference is made to the evaluation report submitted by Petrel Consultants Ltd., on January 14, 1982 (copy enclosed as Appendix A) which covered the initial review and recommendations for new work.

Data Base

In addition to the 950 km of existing seismic data, Forward Resources Ltd. contracted Capilano Geophysical Ltd. to shoot 300 km of data in the form of 12 lines across Blocks A, B and C. Processing was done by Geo-X Systems Ltd. under the supervision of Petrel Consultants Ltd. Both shooting parameters and the processing sequence are outlined in Appendix B.

The 1982 seismic data is superior to the previously shot data due to the higher stack and more modern processing techniques. Generally the data quality is only fair to poor due in part to the following factors:

1) the presence of a very high velocity carbonate rock at or near the surface
2) karst topography

3) variations in the thickness of glacial drift

4) variations in the thickness of perma-frost near and beneath the lakes which are present over much of the area.

Interpretation

Geological targets and regional considerations have been reported previously (Appendix A) and remain unchanged at this time. The Old Fort Island sand is the most prospective formation especially in the northern part of the area where an oil show was encountered in the Stopover well. The southern part of the area i.e. Block C of the Esso agreement is less prospective at this time due to silicification of the old Fort Island sand and to the poorer quality of seismic data which precludes the precise outlining of prospective structures.

Reflections were identified at the Union Stopover well using the sonic log from the Ashland Tedji well to the northwest and the abbreviated sonic log from the Stopover well. Five reflectors were identified on the new data and were correlated and integrated as far as possible with the old data. These include:

- (Base of Franklin Carbonate) Saline River - orange
- Salt member of the Saline River - pink
- Mt. Cap - blue
- Old Fort Sand - green
- Marker within the Proterozoic - purple
- Structure maps were prepared for the Old Fort Sand and the Proterozoic marker. Four isochron maps were also prepared on the following intervals:

- Salt to Old Fort

- Salt to Mt. Cap

- Mt. Cap to Old Fort

- Old Fort to Proterozoic marker

The structure maps illustrate features of interest which are considered to be controlled by two ages of structural deformation. Present day structures which have been tested by 4 wells in the area are noted to a large degree on surface geological maps. The second type of feature is related to older structures which are illustrated by isochron thinning between various markers and structural highs. Many faults are present throughout the area and are seen both on surface mapping and on seismic data. On the seismic maps these are not shown due to the sparcity of control which limits the outlining of fault patterns. Contouring trends however show the structural grain.

The main features of interest and those recommended for testing include the following:

1) Block B, Lease No. 3926

   N.E. Co-ordinates 67°30' N, 123°45' W

   Location - Seismic line FR 5, SP 537

This is a structural high on all horizons on the north or down side of an ancient Proterozoic fault. Situated south of the Stopover test it is supported by a thin on the Mt. Cap to Old Fort interval indicating early movement.

2) Block B, Lease No. 3828

NE Co-ordinate 67°30' N, 124°15' W

Location - Seismic line FR-7, SP 625

This is a NE - SW trending high structure culminating as a closure as shown on the Old Fort structure map. The thinning of intervals above the Old Fort indicates the probability of a favourable old structure being present even though very little surface expression is noted. The area could be quite large as is indicated on the Salt to Old Fort isochron.

3) Block A, Lease 3902

NE Co-ordinates 67°40'N, 123°45' W

Location - Seismic line FR4, SP 701

This is a high feature SW of the Stopover well and separated from it by faulting. Isochron thinning above the Old Fort is coincident with the high and as such this is believed to be an older feature and more prospective.

4) Block A, Lease No. 3903

NE Co-ordinates 67°40', 124° 00 W

Location - Near intersection of seismic lines FR 2 and FR 3

This feature is of interest due to the coincidence of a structural high on the Old Fort sand and thinning in all isochrons (Salt to Mt. Cap; Salt to Old Fort; Mt. Cap to Old Fort). Further control to the north and west should be obtained over this feature before drilling.

Further Program

Apart from the three locations believed suitable and ready for drilling, there are other leads in the area which merit additional seismic work.

In Block C, the East Maunoir M-48 well was drilled on a complex, faulted, recently deformed anticline. Indications of older structuring are shown which suggest a separation of the high into two lobes, the southern one being untested. Seismic data is poor in this area and resolution is doubtful. It is possible that a high stack, NW - SE line through the well as shown on the program map would be of value.

Area of interest No. 4 in Block A could be altered by contouring and additional program is recommended to resolve this lead.

The NW corner and north boundary of Block A does not have seismic coverage and the prospects are not defined. Some lines are recommended in this area.

Conclusions

With present seismic coverage and geological knowledge, several structural features of interest have been defined. Two structural grains are in evidence such as the NW - SE trend tested by the Maunoir and Colville wells and secondly NE - SW trends shown on Block B and to some extent on Block A. The latter appear to be older structures and more favourable for hydrocarbon migration and accumulation.

Block C is considered to be the least prospective of the three Blocks due to the decrease in reservoir quality and the poor quality of seismic data obtained in the area.

Recommendations

Three wells are recommended for drilling, two on Block B and one on Block A, as described above. In addition new seismic data should be acquired as discussed above. We also recommend that some re-processing of selected old data be undertaken near the areas of interest.

APPENDIX A

REPORT ON

THE

COLVILLE HILLS AREA

66° - 68°N, 123° - 125°W

For

FORWARD RESOURCES LTD.

By

PETREL CONSULTANTS LTD.

December 1981

P. Viney

J.D.T. Crane

COLVILLE HILLS, N.W.T.

66° - 68°N, 123° - 125°W

Introduction

The study area, approximately 600,000 hectares, extends over three physiographic provinces in the Northwest Territories east of the MacKenzie River and north of Great Bear Lake. The area, a farmout from Esso Resources, covers parts of the Colville Hills, the Horton Plain and the Great Bear Plain (see Davis and Willott, Bulletin Canadian Petroleum Geology, Volume 26, No. 1 (March, 1978) pp. 105-122).

The farmout area is divided into three blocks for contractual purposes: the farmout agreement requires that 100 km of CDP seismic data be obtained in each of three blocks prior to May 1, 1983 to maintain the farmout. To earn a 50% interest in parcels in each block, a well shall be drilled in each block prior to May 1, 1984. These wells shall be drilled 15 m into the Proterozic or to a total depth of 1725 m, whichever is lesser.

An initial condition prior to seismic exploration or drilling was the re-interpretation of presently available seismic data. Following this a recommended seismic program was to be presented.

Data Base

The seismic data presently available consisted of approximately 950 km of CDP data provided by Esso Resources. The Esso data obtained in 1972, 1973 is in their variable density format while the Union Oil data obtained in 1974 and 1975 is in the usual "wiggle" variable area format.

The data quality is considered to be quite poor but some improvement is shown by horizontal compression displays which give a better optical definition of the bands of reflected energy. All data used was corrected to a 1000 foot datum using a datum velocity of 18000'/s after being recorded in 300% and 400% CDP format.

The topography and surface geology has a considerable effect on record quality. "The most extraordinary feature about the topography of the Colville hills is how closely the present morphology reflects the structure of the region" (Davis and Willott, 1978). On many of the topographic highs, where bedrock is very near the surface, record quality deteriorates, the energy seemingly dissipated or not transmitted into the limestone. Karst topography is developed on the limestone surfaces of the area. In some low lying areas record quality is apparently adversely affected by the thickness of glacial till or moraine and/or poor static corrections.

Regional Geology

The geologic section in the area consists of Proterozoic sands and shales, Cambrian sands, shales and evaporites overlain by Ordovician and Silurian limestones and dolomites. In the western part of the area some limestones of Devonian age are present. In the west, south and eastern parts of the area, Cretaceous sands and shales rest unconformably on the Paleozoic surface. Several unconformities occur within the section; between Lower and Upper Ordovician and between Ordovician and Devonian. The area has experienced considerable block and strike-slip faulting which is felt to be basement controlled. Many of these faults were probably active at various times throughout geologic history.

The main reservoir target is the basal Old Fort Island sand which appears to increase in porosity from the Good Hope well in the south to the Stopover well in the north which tested 2550 feet of salt water. Oil staining has been noted throughout the area. One could expect reservoir quality of this basal transgressive sand to be best around and over old topographic highs.

Interpretation

Reflections were identified by using the sonic log from the Ashland Tedji Lake well to the northwest and other logs from the 4 wells within the control area. Three reflectors correlated, insofar as possible, include:

- Saline River (Base of Franklin Carbonate) - orange

- Salt member of the Saline River - red

- Old Fort/Proterozoic - green

Structure maps were prepared on the lower two formations and an isochron map from Salt to Old Fort/Proterozoic was constructed.

As noted, the present day structures are illustrated at the surface and are mappable from geo-photo work. All wells drilled in the area have been located on these features. Efforts were made to locate older structures, from seismic, which may not be evident as surface expressions and which would be of interest for possible hydrocarbon accumulation in the older sands.

Several features of interest are noted as follows:

1) The main feature which merits further evaluation is the structural high and isochron thin located in block 6616 (Lease No. 3928 67°30'N, 124°15'W). This feature is considered to be "Pre Salt" in age and is not illustrated at the surface.

2) The second feature of interest is the fault controlled feature in the SE/6614 and NE/6619 (Lease No.'s 3926, 67°30'N, 123°45'W,, 3931, 67°20N, 123°45'W). This is also an older untested structure.

3) The Union Stopover Lake L-34 well was drilled on an anomaly that extends north and east of the well. Seismic control should be obtained to establish the presence of north dip that is indicated by surface geology and existing seismic.

4) Northeast and northwest of the first mentioned feature (in Block 6616) there are indications of structural highs; (see Block 6583, Lease No. 3907 67°50'N, 123°45'W: and Block 6586, Lease No. 3910 67°50'N, 124°30'W). This area appears to be updip from No. 1 feature but quality and amount of control is so poor that the age of structuring is unknown.

5) An extensively faulted area extends between Union IOL E. Maunoir M-48 and the Union Decalta Good Hope A-40 well, which are drilled on separate anticlines. Several closures, against faults, are anticipated.

Shooting Parameters

Following an analysis of the existing data and consultations with Esso Resources the following field parameters are recommended:

1454-33-0-33-1454 meter split spread

96 trace floating point instruments

33 meter group interval

66 meter shot point interval

2400%

9 geophones over 33 meters

14 Hz geophones

2 ms sample

3 sec. record

1 hole per shot point, 9 meters deep

2 kg powder

Drilling is known to be difficult and it is believed unnecessary to drill holes deep into the carbonates. With the above parameters, 219 meters (720 feet) per mile of drilling is required. Past drilling experience indicates about 600 feet per day per drill can be expected, necessitating the use of 6 drill shifts per day for 5 miles per day production.

2400% recording is recommended after viewing experimental data assembled by Esso. Exact static control is necessary in order to obtain a good quality stacked section and this extra control is provided by 66 meters spacing. In addition an extensive noise train necessitates using a mute pattern which effectively reduces the stack percentage in the zone of interest. Hence the 2400% shooting, results in about 1600% data in part of the section.

Proposed Seismic Program

The proposed seismic program is illustrated on the enclosed Old Fort/Proterozoic structure map. This program has been co-ordinated with ideas presented by Jim Davis following his study of surface features.

The northern two blocks are thought to be of most interest and additional program (over 100 km) is shown on these. We recommend that, if contractually possible, extra program be shot in the north and that the southernmost program on Block C be reduced proportionally.

APPENDIX B

Shooting Parameters - 1982 season

- 1584 m - 33 m - 0 - 33 m - 1584 m slit spread
- 96 trace DFS V floating point instruments
- 33 meter group interval
- 132 meter shot point interval
- 1200%
- 9 geophones over 24 m
- 14 Hz L15 geophones
- 2 ms sample rate
- 3 second record
- 1 hole per shot point, 18 m deep
- 2 Kgm dynamite

Processing Sequence - 1982 data

Processed by Geo-X Systems Ltd.

- Digital conversion - demultiplex
- Amplitude recovery
- Deconvolution - time variant slope; prewhitening 3%
- Apply structural corrections to 305 m datum
  - elevations; weathering and drift
- Apply preliminary normal moveout

APPENDIX B (Cont'd)

- Scaling
- Calculate and apply surface residual statics
- Display work section (100%)
- Edit
- Apply surface consistent statics
- Apply final normal moveout
- Apply cross-correlation statics
- Apply mute
- Gather - 1200%
- Stack
- Filter 18/25 - 90/100
- Final equalization
- Ronda