GM 11258

GEOLOGICAL REPORT, ST. LAWRENCE LOWLAND AREA

Documents complémentaires

Additional Files

Licence

License

Énergie et Ressources naturelles
Québec

N.T.S. 31-I, 31-H

BALD MOUNTAIN OIL COMPANY, NPL

GEOLOGICAL REPORT

ST. LAWRENCE LOWLAND AREA

PROVINCE OF QUEBEC

11258

McPHAR GEOPHYSICS LIMITED

BALD MOUNTAIN OIL COMPANY, NPL

GEOLOGICAL REPORT

ST. LAWRENCE LOWLAND AREA

PROVINCE OF QUEBEC

INTRODUCTION

The Bald Mountain Oil Company has acquired the oil and gas rights for two large areas in the St. Lawrence Lowland region of the Province of Quebec.

1. The Sorel area holdings include the contiguous Berthier 60,000 acre concession and the Sorel 62,650 acre concession.

2. The Pointe du Lac holdings were acquired as a farmout agreement from Inter-City Propane Inc. and contain 60,000 acres.

Access is excellent to the concession areas by road, rail, and water. The Montreal-Quebec north shore highway and railroad cross the north portion of the Sorel holdings and the Pointe du Lac concession. South shore railroad and highways cross the south portion of the Sorel concession. The St. Lawrence River is navigable by deep water vessels and bisects the areas of interest.

The occurrence of natural gas has been known for many years in the St. Lawrence Lowland area between Montreal and Quebec City. Some limited exploitation of these resources has occurred principally in the areas of Mascouche, Yamachiche, and St. Genevieve. Recent shallow

drilling has resulted in the discovery of several wells with commercial possibilities in the Pointe du Lac area. A gas well drilled several years ago in Sorel harbour gave a large sustained flow of natural gas.

The purpose of this report is to describe the geological environment of the concession areas and discuss the possibilities for exploitation of natural gas. A geological report was prepared for the Bald Mountain Oil Company by J. P. Nowlan, dated March 18, 1958. This report summarizes all exploration activities of the Bald Mountain Oil Company to that date. Since that time several successful shallow gas wells have been completed on the adjoining concession in the Pointe du Lac area. These wells are of a type not anticipated previously and will constitute the main emphasis of this report.

The geological information contained in this report is based on several reports prepared by T. H. Clark, including Quebec Department of Mines preliminary report #204, on well data contained in Quebec Department of Mines report S-49, and on results of recent exploration activities in the St. Lawrence Lowland area.

SUMMARY & RECOMMENDATIONS

There are evidences of natural gas in many localities throughout the St. Lawrence Lowland region. A limited amount of sporadic exploration work has taken place over the last hundred years. Much of this work was poorly planned and only limited use has been made of the natural gas.

In recent years, the Bald Mountain Oil Company and others

have undertaken well-planned exploration programmes. As a result of this work, there is much new information available. It appears that there are good possibilities of finding both shallow and deep natural gas occurrences in sufficient quantities for economic exploitation.

In both the Pointe du Lac and Sorel areas, surficial natural gas fields have been located in gravel beds covered by heavy clay horizons. Six natural gas discoveries have been reported in the vicinity of Pointe du Lac and adjoining the Bald Mountain holdings. In 1956, the Federal government encountered a 5,000,000 cubic foot gas flow in Sorel harbour with the source in a buried gravel bed.

Since the geological and physiographical conditions are similar within the Bald Mountain holdings, it is recommended that an exploration programme for surficial gas deposits be undertaken.

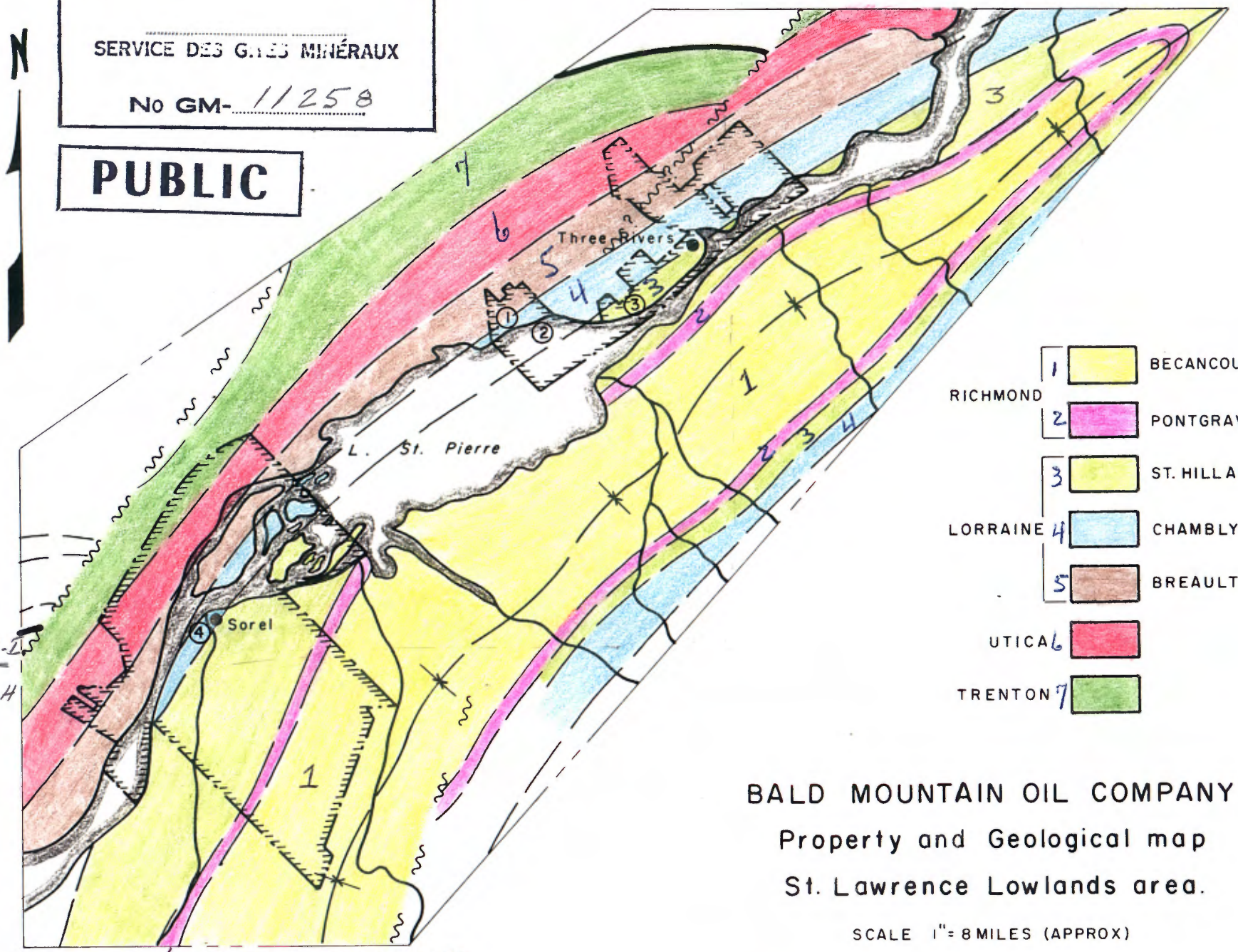
The following areas, because of proximity to known gas occurrences and similar geologic and physiographic settings, are suggested for first consideration. These areas are noted by number on the accompanying map.

1. Northwest tip of the Pointe du Lac holdings extending north from the shore of Lac St. Pierre.

2. The adjoining off-shore area where water depths are shallow and extending southeasterly towards Pointe du Lac.

3. The on-shore extension to the east of area (2).

4. The Sorel harbour area adjacent to the well drilled by the Federal government in 1956.



GEOLOGY AFTER VARIOUS MAPS BY T.H.CLARK

BALD MOUNTAIN OIL COMPANY

Property and Geological map

St. Lawrence Lowlands area.

SCALE 1" = 8 MILES (APPROX)

TO ACCOMPANY GEOLOGICAL REPORT BY A.W. MULLAN, JUNE 28, 1961

Both concessions contain large additional acreages that offer good exploration possibilities and should be considered for future activities.

PHYSIOGRAPHY

The St. Lawrence Lowlands conform in general to the old flood plain of the St. Lawrence River and corresponds closely to the underlying geology. The lowland area is bounded on the northwest by the Pre-Cambrian rocks of the Canadian shield and to the southeast by the much deformed horizons of the Appalachian system.

The development, character, and extent of the St. Lawrence River flood plain has received limited attention to date. In general, the bedrock is covered by thick glacial debris consisting of boulder clays and gravel. Post glacial deposits resulting from periodic flooding cover much of the glacial debris and are composed of clay and sand. The depth of overburden can vary from nothing to as much as 400 feet. Considerable information is available from logs of water and gas wells drilled throughout the Lowland area.

The present land surface is remarkably flat except where pierced by the Monteregian Hills or cut by deeply eroded rivers flowing into the St. Lawrence River.

GENERAL GEOLOGY

Sedimentary horizons of Ordovician age directly overlie the Pre-Cambrian basement rocks throughout most of the St. Lawrence Lowland region. The sedimentary rocks have been gently folded into a synclinal

basin with its axis paralleling and lying to the southeast of the St. Lawrence River. A series of younger intrusives presumed to be of Tertiary age have penetrated the Ordovician sedimentary rocks and form the Monteregian Hills.

Both the Sorel area holdings and Pointe du Lac holdings lie to the north of the synclinal axis. The formations dip gently to the southeast at about 2 degrees.

TABLE OF FORMATIONS

Quaternary

- Post glacial clay and sands
- Glacial deposits of boulder clay, gravel, etc.

Ordovician - Richmond Group

- Becancour River Formation
- Pontgrave River Formation

- Lorraine Group
  - St. Hilaire member
  - Chambly member
  - Breault member
- Utica Group
- Trenton Group
- Black River Group
- Chazy Group
- Beekmantown Group
- Potsdam Group

Pre-Cambrian

DESCRIPTION OF FORMATIONS (Stratigraphy)

The Pre-Cambrian shield is the basement complex and underlies the sedimentary formations. Comparatively few drill holes have penetrated the Ordovician to the Pre-Cambrian.

The Potsdam group has been variously described as Ordovician or Cambrian in age. In this region, the Beekmantown grades into the Potsdam without obvious unconformity, therefore for the purposes of this report the Potsdam will be classified as of Ordovician age. The western portion of the area contains great thicknesses of Potsdam sandstone. It diminishes to the east and disappears in the vicinity of Sorel.

The Beekmantown Group includes both dolomite and sandstone. The basal sandstone grades into the upper Potsdam. This formation also thins to the northeast and disappears just beyond Three Rivers. Traces of solid hydrocarbon have been noted in cavities.

The Chazy Group is composed mainly of calcareous formations with thin interbeds of quartzite and are believed to underlie both concession areas.

The Black River Group is a thin series of dolomites and limestones with irregular sandstone beds near the base. They extend under the Sorel area, but are not known in the vicinity of Pointe du Lac.

The Trenton Group is composed almost entirely of a calcareous series that include limestone, dolomite, and shales. Individual beds are irregular in extent. Petroliferous formations occur in both the lower and

upper Trenton. The Deschambault formation of lower Trenton age is a coarse grained detrital limestone that yields traces of petroleum. Batiscan #1 gas well located an important gas occurrence in this formation. The Trenton Group underlies both concessions and is believed to attain thicknesses in excess of 600 feet.

The Utica shales extend beneath the Sorel and Pointe du Lac areas. The shales are impervious, lack porosity and are weakly petroliferous.

The St. Hilaire, Chambly, and Breault members of the Lorraine Group are believed to surface beneath the overburden under both concessions. They are composed of shales and discontinuous beds of sandstone. The sandstones are generally entirely enclosed in an envelope of shales and could be considered as possible gas reservoirs. The surficial gas occurrences of both the Pointe du Lac and Sorel areas are believed to be positioned over the Chambly member.

The Richmond Group formations are the youngest known consolidated sediments in the Lowland region. Calcareous shales and limestones of the Pontgrave formation are overlain by red shales and sandstones of the Becancour formation. These horizons would act as a good impervious cap rock for the retention of natural gas.

STRUCTURE

Folding

The Ordovician formations occupy an elongated synclinal basin with its axis located southeast and parallel to the St. Lawrence

River. To the northwest of the fold axis, the horizons dip to the southeast at approximately two degrees. On the southeastern side of the axis, thrusting from the Appalachian disturbance has resulted in a belt of tightly folded horizons adjacent to the front. This condition gradually disappears as the synclinal axis is approached.

Subsidiary fold structures have been located in several areas. Lack of bedrock exposure makes the recognition of these structures difficult. Anticlinal axes are shown on Quebec Preliminary Map #642 in the vicinity of the St. Frances and Becancour River. Variations in dip have been recorded both east and west of the fold axis and likely result in the formation of terrace structures. The anticlinal folds and terrace structures are important conditions for the formation of structural traps.

Faulting

An en echelon system of boundary faults characterizes the Ordovician-Pre-Cambrian contact along the northwest side of the basin.

The eastern boundary of the basin is delimited by a system of thrust faults associated with the Appalachian revolution. The thrust faulting is complex and has resulted in tight overturned folds and shallow dipping faults.

The synclinal basin proper has also been faulted. The St. Barnabe fault, the Bas de St. Rose fault, and the St. Angela fault all show significant strike length and movement. The down throw on the St. Barnabe fault is believed to exceed 1000 feet. Other major faults likely exist under the generally heavy overburden.

ECONOMIC GEOLOGY

The existence of natural gas has been known in the St. Lawrence Lowland region for many years. The more significant gas occurrences have been located to the west of the synclinal axis. Water wells drilled in the Mascouche, Yamachiche, and St. Genevieve areas have resulted in significant gas occurrences and some economic exploitation has been achieved. Recently gas has been located under heavy clay overburden in the Sorel and Pointe du Lac vicinities.

The gas occurrences can be divided into two main types. The first type would be considered the conventional occurrence and is found at some depth in a porous rock horizon. The second type appears to have a source in gravel beds lying on or near the bedrock surface and capped by 100-200 feet of impervious clays. The deep gas occurrences are discussed in detail by J. P. Nowlan in his report to Bald Mountain Oil Company dated March 18, 1958. The significance of the shallow source or surficial gas occurrence has only recently been fully appreciated. Gas flows sufficient to supply several homes have been discovered before in the overburden. However, in the last few years, several gas occurrences have been discovered with a daily flow in excess of 5,000,000 cubic feet.

The significant surficial gas deposits have been found to date in areas of relatively heavy overburden. The reservoirs are porous gravel beds lying on or near the bedrock surface.

The gravel deposits are believed to have been laid down during glacial times. As the glacier retreated, a large lake likely existed

between the retreating ice and the frontal zone of the Appalachian system. The gravel would most likely accumulate where heavily laiden outwash rivers entered the glacial lake. The gravel bed occurrence could thus be quite random and conceivably could occupy both hills or depressions on the old bedrock surface. As the glacier moved farther back, the gravel beds would be capped by clays.

The location of the gravel bed might have a distinct bearing on its subsequent accumulation of natural gas. The gravel beds draped over old hills in the overburden would appear to offer best conditions for the upward migration and accumulation of natural gas.

The source of the gas is controversial. A recent analysis of surficial gas from the Pointe du Lac area reported a methane content over 98%. The average methane content of natural gases is closer to 90% with the remainder composed of less volatile hydrocarbons, carbon dioxide, nitrogen, etc. Gases containing a high methane content can result from the putrification of organic matter from within the overburden itself. The high methane content could also be explained as a result of slow seepage from a reservoir rock formation at some depth. Since methane is usually the most volatile constituent of natural gas, an accumulation of gas under the overburden would be expected to contain a higher proportion of methane than the source reservoir.

It has been noted that the surficial gas occurrences of the Sorel and Pointe du Lac areas appear to be positioned over the up dip exposure of the Chambly member of the Lorraine Group. The importance

of this condition is not known, but the porous sandstones of the Chambly member might merit further consideration as potential gas reservoirs.

EXPLORATION METHODS

Drilling through the overburden to bedrock in areas of known gas occurrences is suggested as the primary exploration method. Records from old wells drilled for water or gas should provide valuable information and at least delimit areas of minimum interest.

Several indirect techniques offer interesting possibilities for the location of drilling targets.

1. Photo Geological

Air photograph interpretation frequently contributes valuable data as to subsurface conditions. Basins containing uniformly deep overburden cover should be easily outlined, particularly when supplanted by records available from local water and gas wells. A careful study of airphotos over known surficial gas occurrences might suggest some direct clues for exploration.

2. Seismic

A refraction seismic survey can outline the bedrock surface through an overburden depth of 500 feet with an accuracy of plus or minus ten feet. A gravel-clay interface would be difficult to locate directly with seismic methods unless thickness of the order of 40 feet or more is encountered. In any event, test lines should be run over known occurrences before embarking on a large scale programme.

3. Resistivity

A resistivity survey using an expanding Wenner spread technique has been successfully used to outline the bedrock floor. The resistivity technique has been used in Canada, U.S.A., and Australia to locate buried gravel deposits. Consequently this method offers good possibilities as a dual purpose system; to determine the depth to bedrock, and check for the existence of buried gravel beds. Again, any such programme should start with test programmes over known gas occurrences.

McPHAR GEOPHYSICS LIMITED

A. W. Mullen A.R.Sc.
Geologist.

REGISTERED PROFESSIONAL ENGINEER
A. W. MULLAN
PROVINCE OF ONTARIO

Dated : June 30, 1961.

McPHAR GEOPHYSICS LIMITED

CERTIFICATE

I, Ashton W. Mullan, of the City of Toronto, in the Province of Ontario, hereby certify :

That the material in the geological report for the Bald Mountain Oil Company, NPL, dated June 30th, 1961 is based on the following :

1. McPhar Geophysics Limited, of which the undersigned is Chief Geologist and Vice-President, managed the field operations and offered consultant and supervisory services to the Bald Mountain Oil Company during the period November 1956 to January 1958. McPhar provided a field geologist to supervise the drilling operations and provided a minimum of four consulting days per month. The McPhar consultant staff at this time consisted of J. P. Howlan, P. Eng., E. G. Robinson, Ph. D., and A. W. Mullan, P. Eng.

2. Geological reports by T. H. Clark both published and unpublished were made available to the undersigned.

3. Well data contained in Quebec Department of Mines Report S-49 plus a summary of water well data prepared by T. H. Clark were available for study.

4. The author has a personal knowledge of parts of the St. Lawrence

CERTIFICATE

I, Ashton W. Mullan, of the City of Toronto, in the Province of Ontario, hereby certify :

1. That I am a geologist and a member of the Geological Association of Canada with a business address at 139 Bond Avenue, Don Mills, Ontario.

2. That I am registered as a member of the Association of Professional Engineers of the Province of Ontario.

3. That I hold a B. Sc. degree from McGill University.

4. That I have been practising my profession as a Geologist for eleven years.

5. That I have no interest, either direct or indirect, in the concessions described in the accompanying report, nor in the shares of Bald Mountain Oil Company, nor do I expect to receive any.

6. That the material in this report is based on a study of all available published and unpublished geological and geophysical data pertaining to the area involved.

Dated at Toronto

This 30th day of June, 1961.

A. W. Mullan, B. Sc., P. Eng.

Lowland region as a result of studies and field trips made while a student at McGill University.

Dated at Toronto

This 13th day of July, 1961

A. W. Mullan, B.Sc., P. Eng.