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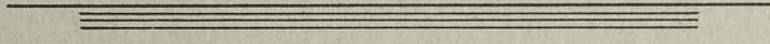
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PROVINCE OF QUEBEC, CANADA  
DEPARTMENT OF MINES AND FISHERIES

HONOURABLE ONESIME GAGNON, MINISTER.

L.-A. RICHARD, DEPUTY-MINISTER.

BUREAU OF MINES  
A.-O. DUFRESNE, DIRECTOR.



ADVANCE REPORT  
ON THE  
OIL PROSPECTS IN EASTERN GASPÉ  
TOWNSHIPS OF  
LAROCQUE, GALT, BAILLARGEON AND LAFORCE

by

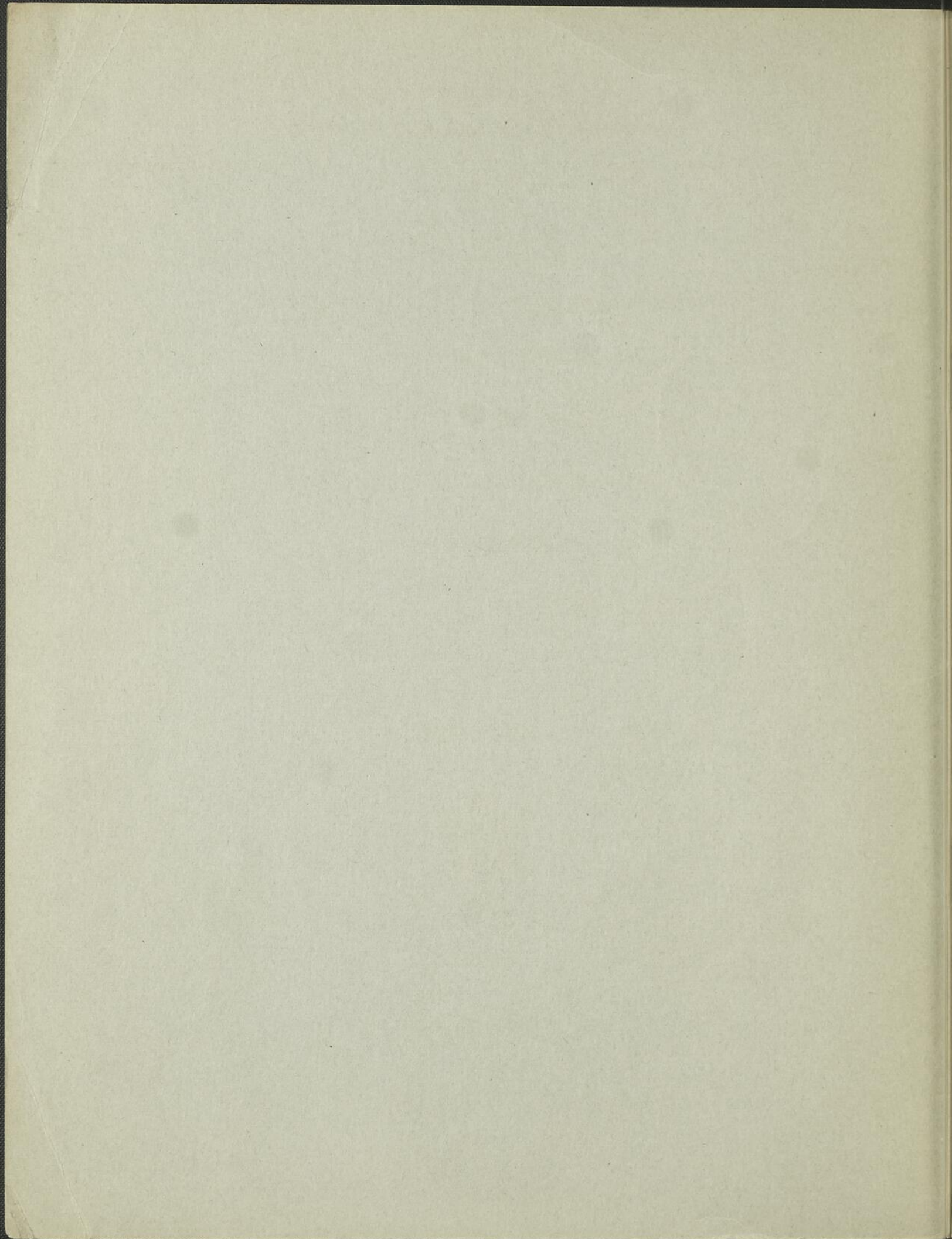
I.W. JONES



QUEBEC

FEBRUARY 1938

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INTRODUCTORY STATEMENT

Oil seepages were observed and recorded in eastern Gaspé more than a hundred years ago. Some geological investigations of the region were made at various times, and considerable expenditure was incurred in unsuccessful attempts by drilling to find oil in commercial quantity.

In view of the fact that all the geological work previously done here had been of a reconnaissance nature, with the possible exception of investigations along the coast of Gaspé bay, it was felt that a more detailed, critical study should be made which, while adding to and possibly revising the information already known, would assure that any conclusions drawn therefrom would be based on data more satisfactorily complete than had previously been obtained. Such a detailed examination would determine to what extent the previous drilling attempts can be considered as having tested the region, and would determine whether further drilling is warranted to again search here for oil in commercial quantities.

With these considerations in view, a detailed geological examination of the region was begun in 1937. During the four months spent in the field in the summer and autumn of that year, the parties entrusted with this task covered the townships of Larocque, Galt, the larger parts of the townships of Laforce and Baillargeon, and the western parts of the townships of Gaspé Baie Sud and York. The writer, acting as senior investigator, was in charge of the work in the area bordering the York river, which comprised all the investigations made in Larocque, Galt and Gaspé Baie Sud townships and which extended south of the river for distances of two to three miles into the townships of Baillargeon and Laforce. The work in the area bordering St-John river, which flows through the southern part of the region, was under the direction of H.W. McGerrigle.

A final report on these areas will await the complete compilation and study that are still under way of the results obtained during the field-work. A stage has been reached in the investigations, however, when a report such as the present one is permissible in order to draw attention to the general conclusions that have been drawn to date and to meet the demand that exists for some information on the oil prospects of this region.

GENERAL GEOLOGY

The exposed rock formations in much of the area are of Devonian age. They are entirely of that age in the part covered by the writer, but in the southern part, examined by McGerrigle, there are also rocks of Silurian and possibly, too, some of Ordovician age.

The Devonian rocks, which here are all of sedimentary origin, are broadly divisible into two major series, each of considerable thickness, measurable in thousands of feet.

The older of these two series of Devonian rocks has usually been referred to as the "Gaspé Limestone Series". While limestone predominates in it in the exposed sections, shale also is abundant and there are also chert, sandstone, and conglomeratic zones. The upper part of this predominantly limestone series is characterized by the abundance of chert and siliceous matter it contains through a considerable thickness. Most of the rocks of the limestone series exposed in that part of the area covered by the writer belong to this upper cherty horizon, known as the Grande Grève formation. Some of the lower, more argillaceous and arenaceous divisions of this series are exposed, but to a small extent, and nowhere in the writer's territory are the lowermost parts of the Devonian showing at the surface; they are more prominently revealed, however, in the neighbouring areas to the north, west and south.

The younger Devonian rocks, overlying the limestone series, have usually been called the "Gaspé Sandstone series" because of the abundance of sandstones in the coastal sections where this series was first studied. While sandstones predominate in the sections exposed along the coast, shales are so abundant, particularly in the inland exposures, that the term "Gaspé Sandstone" series becomes misleading. Shales, accompanied by argillaceous sandstones, are particularly abundant in the region examined during 1937. The sandstones observed in the area covered by this report are, for the most part, feldspathic and they vary from fine to coarse in grain. In some parts of the series there are zones of massive,

coarse feldspathic sandstones of a light shade that may serve as approximate horizon markers. Another zone, or possibly more than one, which has characteristics distinctly different from the remainder of the formation, is composed of light grey to pink quartzite and quartzitic sandstone. This zone is found towards the base of the series not far, but at a distance yet to be confirmed, above the main body of limestones. In the lower part, but yet distributed through a zone of extensive thickness, there are thin layers of strongly calcareous shales and sandstones, and in some places the calcareous content is so high that the rocks may properly be classified as limestones. West of the area at present under consideration, these limestone beds increase in number, until near York lake the series is predominantly one of limestone.

Fossils were collected from several horizons, particularly in the lower calcareous parts of the shale-sandstone series where there are some layers composed almost entirely of fossils of various species.

#### STRUCTURAL GEOLOGY

The rocks of this region are folded into a succession of anticlines and synclines, and the formations are thereby distributed in alternating bands. Referring particularly to the area examined by the writer, the shale-sandstone series usually occupies the synclines, while erosion has exposed the older, limestone series, as a rule, along the anticlinal folds. The folds are usually of a plunging nature, the plunge of the beds at the axes being in some places towards the east and in others towards the west, such that, within the area examined in 1937 and in neighbouring regions, the anticlinal structures may have the characteristics of elongated domes and the synclines may be in the form of elongated basins.

In addition to the regional folds, there are local changes in dip that give flexures of monoclinical and isoclinal nature. It is possible, however, that these structures may not persist either along their strike or at depth below their occurrence on the surface.

The rocks, in addition to being folded, are fractured and faulted in various degrees. In some parts the faulting has been excessively intense, but in other parts of the region there are extensive areas where the faults are negligible in number and of minor importance. Many of the faults observed are of the normal type. In some instances the displacement along them does not seem great and it seems that the intensity of movement along their planes may, often, diminish at depth. At present, there do not appear to be large faults of the thrust type in the area just examined, but there yet remains some compilation of the results of the field examination that may shed further light on this and other structural problems.

As a result of these folding and faulting movements to which the rocks have been subjected, horizontal strata are rarely found and, when so, for brief intervals of space only. The strata are nearly everywhere inclined, sometimes at high angles, but often over wide stretches the dips are relatively low.

A cross-section through the rocks along the western boundaries of Baillargeon and Galt townships would serve to illustrate the general succession of structural features and the distribution of the various formations. Such a cross-section is described below, but it should be understood that factors such as faults and plunging of folds modify these conditions in areas away from the chosen line of section — In the St. John River valley, the rocks, of Silurian and possibly Ordovician age, form the crest of an anticlinal zone in which, however, the strata are much distorted and disturbed by subsidiary folds and faults. Proceeding northward from the St. John, successively younger strata are encountered, dipping generally northward, until the upper contact of the predominantly limestone series of Devonian age is reached at a point about midway between the St. John and York rivers. Here, the hard, cherty limestones and the succeeding younger Devonian series of interbedded shales and sandstones dip relatively steeply north, but the angle of dip decreases rapidly as the axis of a broad syncline is approached. The axis of this syncline follows, or is near, the bottom of the valley of York river for several miles on either side of the line of section that has been chosen. Continuing northward from York river, the strata are of the shale-sandstone series, dipping southward at angles usually between 15 and 30 degrees, until the contact with the underlying limestone series is reached about  $1\frac{1}{2}$  miles north of the river. There is some evidence of faulting in the limestones near the contact, but the displacement does not seem great and the dips continue to be southward in the limestone strata as far as the crossing of this line of section with Patewegia brook. Steeper dips prevail in this part and a zone of faulting is reached. Some of the faulting here appears to be of major dimensions, particularly along a northwest-southeast course, obliquely to the usual strike of the formations. It is near this point, also, that the direction in which the strata dip changes from being in general south, as they are for the three miles from York river to this point, and the beds bend to dip northward. The shale-sandstone series again appears on the northern limb of this anticlinal structure about two-thirds of a mile north of the crossing of the Galt township line and Patewegia brook, and the rocks of this series occupy the remainder of the surface northward along this line of section to beyond the north boundary of Galt township. Limestone belts, however, are found west of this line and the structure is

one of a succession of folds and faults the detailed nature and magnitude of which are yet being studied. In general, however, the northeastern part of Galt township is occupied by a broad syncline with gently dipping strata, but on which there are superimposed a few other, smaller folds. The geology and structure north of Galt township have already been mapped and described by the writer's investigations of 1934.

#### OIL SEEPAGES

Seepages of oil were observed in various places in the area examined during 1937. These issue from limestone beds in most instances, but in some places they are along a fault-contact between the limestone series and the younger series of shale and sandstone. Seepages of oil also issue from the rocks of this younger series in the region east of the one covered by this report. The seepages are usually found in zones where the rocks are fractured, but in some places thin films of oil and an odour of petroleum are noticeable, however, in solid limestones and along some joint-planes in these rocks.

#### PREVIOUS DRILLING OPERATIONS

Extensive drilling operations were conducted in this region, mainly during the latter part of the last century, and, in all, 58 wells were drilled, most of which are within or very near the area examined in 1937. The drilling operations ceased in 1902, with the exception of the drilling of another well in 1913 at a locality about ten miles southeast of the area now under discussion. Oil was found in many of these wells, and from some of them there is still a small flowage of oil. The oil from the wells is green, dark brown, and claret red or amber in colour; the base is classified as paraffin to intermediate and the gravity varies for different wells from about 30° to 47° A.P.I. (Analyses are given in Que. Bur. Mines, Ann. Rept., 1929, Pt. B, and in Mines Branch, Dept. Mines, Ottawa, Pub. No. 765).

The oil was obtained in these wells from both the shale-sandstone series and the underlying limestone series, but the larger productions were obtained at the contact of the two series or in the limestones. Depths of the wells were mostly from 1500 to 3700 feet, but in only relatively few instances was the limestone penetrated to much depth because of the difficulty encountered in drilling through the hard, cherty zones with the machines available at that time.

In none of the wells was oil found in commercial quantity. The failure of these wells, however, as will be discussed in the conclusions of this report, should not be considered as having constituted a test of the possibilities of this region.

#### CONCLUSIONS

##### 1. Structural Conditions.

The fact that saline and sulphurous waters exist in the strata, as shown by the presence of springs of this nature and by the finding of such water in many of the wells already drilled, suggests that anticlinal folds or positions on their flanks are probably more favourable for the finding of oil than are the synclines. While the crests of some, at least, of the major anticlines are fractured, there are extensive areas along their flanks, particularly in those parts dipping southward, where the strata are relatively unbroken and are not steeply inclined.

There has been some faulting which, in some parts, has been of sufficient magnitude to render slight the chances of finding oil in commercial quantity in such places, but by no means can the area be considered as having been so excessively broken by faulting that no part remains where favourable conditions might exist. In fact, there are wide zones with otherwise favourable structure where faulting, if present, is of negligible importance. Furthermore, in many cases it appears that the fault-planes may have been effectively sealed by various means, such as by vein material deposited in them from solutions, so that oil which may be present has been prevented from escaping along these channels.

##### 2. Sources of the oil.

While oil has been found in both the major divisions of Devonian strata — that is, in the shale-sandstone series and in the older series of predominantly limestones — it is considered very probable that much, if not all, the oil was originally formed within this limestone series or even in older formations. That formations older than Devonian may be the source of at least some oil is indicated by various features that have been observed: for example, bituminous matter and a strong odour of petroleum have been observed in strata considered as being of Middle or Upper Silurian age in the western part of York township, south of St. John river. An oil seepage has also been spoken of in Baillargeon township, on the south side of St. John river, which seepage, if it exists, would be coming, according to McGerrigle, from strata probably of Lower Silurian age. Still older bituminous strata are known in the Ordovician rocks that are found along the north and south borders of Gaspé Peninsula.

### 3. Previous drilling as a test of the region.

As already mentioned, some 58 wells were drilled in a search for oil in this region, mostly towards the end of the last century but some as early as 1860. In none of these wells was oil found in commercial quantity. At first thought, it would seem that failure on such a colossal scale is sufficient in itself to condemn this region as a possible oil producer. But, on analysis of the facts, it must be said that these wells should not be considered as having constituted a proper test of this field and, indeed, it seems that little strength can be placed on the evidence they offer as a measure of the possibilities of this region.

While in the early history of these operations little may have been known of the conditions under which oil is usually found and some excuse may be accepted for the unsuitable locations of the earlier efforts, it is quite apparent that most of the wells were located with mistaken ideas, or with little consideration, concerning the geological conditions surrounding them. Most of the wells are situated in synclines, or much closer to synclinal axes than they are to the axes of anticlines. There is no doubt that the anticlinal structures, which in present day practice would receive the first attention, have at the best been only meagrely tested. The fact that some oil was found in the synclines may perhaps even be considered as a feature to encourage search farther up the flanks of the folds. Of the 58 wells that were drilled, only 32 penetrated through the shale-sandstone series to the underlying limestone formation. Of these 32 wells, only 11 went more than 200 feet into the limestones and it is doubtful if any of these eleven wells can be considered as having been favourably located with respect to structural conditions. It can be stated, then, that the previous drilling operations have not tested the possibilities of the Devonian limestones, or of the still older formations, in which there is known to be some oil, as indicated by observed seepages and by the results obtained from the wells that did attain shallow depths in the limestones.

#### RECOMMENDATIONS

It may seem superfluous to state that no one can predict the presence of oil in commercial quantity in any region before drilling is done to reach any possible oil-producing horizon, but such a statement is necessary for some individuals who may not be familiar with the conditions under which oil exists in the earth's formations. No such prediction can be made even though it is known that there is some oil in the region, as there is in Gaspé, and it is not the intention of the writer to attempt any prediction in this respect. All that can be asked at the present time, in addition to the questions already answered by preceding discussions in this report, is whether a further search for oil by drilling methods is warranted in this region. To this question, the answer is in the affirmative. It is necessary, however, to impress those readers who may be unfamiliar with oil problems of the desirability of such tests being conducted by individual or organizations possessing experience in such matters and by ones prepared to assume the risks that are involved in activities of this nature. To thoroughly explore the possibilities of the Gaspé region, until satisfaction is attained as to whether oil does or does not exist there in commercial quantity, may be a lengthy procedure incurring large financial expenditures. Unless, by chance, fortunate results are obtained early in such efforts it may well happen that several attempts in different localities and to considerable depths may be required.

At the moment, it does not appear advisable to search in most of the area bordering St. John river within the region examined during 1937. According to H.W. McGerrigle, who examined that part, the strata are highly disturbed and the chances of finding accumulations of oil in Laforce township and the western part of Baillargeon township are not promising. Eastward from this area in that southern section, however, surveys have indicated more hopeful conditions that, it is intended, will be examined in detail during 1938.

The area drained by York river and its tributaries offers more favourable conditions than exist in the southern part of this region, as far as the territory examined in 1937 is concerned.

South of York river, in Laforce township, the structure succeeding the York River syncline is not as favourable as in other parts; a short distance south of the river, the gentle dips of the shale and sandstone beds near the syncline change rapidly to northward dips of high angle that continue in this series and in the succeeding older formations as far as the disturbed zone north of St. John river. This section in Laforce township may, then, be avoided unless more favourable evidence is found. Farther east, on the south side of York river in Baillargeon township and near St. John river in the eastern part of the same township, the northward dips, in general, are not so steep as in the area to the west, and the possibility of sometime exploring there at some distance from the York River syncline should not be overlooked.

A major fault-zone trends northwestward, passing north of Third Lake and crossing York river near the north-south centre line of Baillargeon township and eventually reaching Patewegia brook near the point where this brook is crossed by the Galt-Larocque township

line. The area bordering this fault zone should be avoided, at least until attempts have been made elsewhere, even though along this zone there are some of the strongest surface seepages of oil in the district.

West of this fault zone, in the southwestern part of Galt township and in Larocque township, the formations dip southerly for a considerable distance north from York river. Near the river the strata are too near a syncline to be of much promise, in going northward, successively older strata are exposed as the next major structural feature, an anticlinal zone, is approached. To those who may explore this region by drilling, this southward dipping flank towards the crest of the anticline is recommended for consideration. Drilling well up this flank would, in many places, avoid the upper series of shales and sandstones, and would serve to test primarily the older limestone formations. The oldest geological horizon exposed at the surface in this section would be near the anticlinal crest that crosses Mississippi brook about five miles north of the river and that extends westward to pass near Dartmouth lake. The lowest Devonian strata and, at depth, possibly older formations may be tested without encountering much of the younger, very hard limestones by choosing a site near this anticline, possibly on its southern flank. West of the vicinity of Dartmouth lake, this anticlinal structure apparently plunges westward, while east of that locality the plunge is towards the east.

West of the area examined in 1937, there is a locality where structural conditions appear sufficiently favourable for consideration as testing ground. The rocks there are still older than those exposed near Dartmouth lake; they belong to the lowermost Devonian and, in part, may possibly be of Silurian age. This locality, mentioned in the writer's report for 1935, is in Fletcher township near the crown of another anticline which crosses Patch brook (Madeleine Fork) about two miles north of York river. The crest of this anticline east of Patch brook plunges towards the east, while not far west of the brook the plunge is towards the west. In the absence of abundant exposures at this locality, some investigations should be made to confirm the geological conditions believed to prevail there before the taking of further steps. In 1935 this locality was not easy of access, but now motor-trucks can go as far as the mouth of Patch brook.

For the region east of the northwest-southeast fault zone that has been mentioned as crossing York river near the north-south centre line of Baillargeon township, there are some details of structural conditions that are yet being compiled and studied. It can be stated, however, that there are some localities there which are worthy of consideration by anyone contemplating drilling operations.

If renewed attempts to find oil in this eastern part of Gaspé should meet with success, the search would undoubtedly extend farther in the interior, even as far west as Matapédia valley, where it is believed, similar geological conditions would be found.

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JONES, I.W.

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Advance Report on the oil prospects in  
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