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SUMMARY OF CONCLUSIONS.

This survey and resume is made to roughly cover the larger portion of Alberta and a small part of eastern Saskatchewan, but particularly Southern Alberta, Canada. For Division of Territory, see pages 4 and 5.

SECTION III. FOOT-HILLS AND MOUNTAINS REGION.

Pages 5 - 16.

DESCRIPTION: This embraces territory along the eastern flank of the Rocky Mountains lying between the mountains and the western terminus of the plains area, averaging about thirty miles in width, and included the local districts of Dingman, Monarch, Pincher Creek, &c.

HISTORY: Many wells have been drilled at a total cost of several hundred thousand dollars. Various grades of oil have been found in a few of them at various depths, but none have or will produce in paying quantities.

CONCLUSION: Conditions, geologically and practically, are distinctly and decidedly unfavorable for oil production in commercial quantities. Geologically unfavorable, on account of the faulty and intense folding of the formations in such a manner that any extensive accumulation of oil or gas seems very improbable; and, practically unfavorable, because the formations have been penetrated by the drill to a depth of 3,000 feet in several different places, with no profitable result in any case. While everything is unquestionably and decidedly negative, some oil may, and probably will, be found, but never in substantial and paying quantities.
SECTION IV. WESTERN SYNOCLINAL REGION. Pages 16 - 19.

DESCRIPTION: This includes the territory adjacent to and east of the Foot-hills Region, extending from the International Boundary northward and practically parallel with the Rocky Mountains for a distance of about 500 miles, to a point northwest of Edmonton. Its width is limited by the Foot-hills Region, on the west, and the Belly River Anticlinal Region, on the east.

HISTORY: A few wells have been drilled to various depths, with no favorable results.

CONCLUSION: Compared with area, this territory has had very few tests, but, in the absence of anything favorable from any of same, one must pass negatively. Geologically, being in a Synclinal Region, conditions generally would not be favorable for either oil or gas production in commercial quantities.

SECTION V. EASTERN SYNOCLINAL REGION. Pages 18 - 19.

DESCRIPTION: This is that portion of the plains area extending from the eastern terminus of the Belly River Anticlinal Region, herein described, eastward through the southern portion of the Provinces of Saskatchewan and Manitoba, and is noted herein as a broad, shallow, structural basin.

HISTORY: A few wells have been drilled to various depths, with no favorable results.

CONCLUSION: Conditions and conclusions generally in relation to the Eastern Synclinal Region, seem applicable to all this territory.

SECTION VI. NORTHERN REGIONS. Pages 19 - 24.

DESCRIPTION: The territory within this so-called division lies to the north and includes the northern portion of Alberta and a
portion of the North-West Territory.

**HISTORY:** According to reports of those who have made a survey, there are favorable indications for oil, and gas is being produced in paying quantities near Pelican Falls.

**CONCLUSION:** Practically, all the region seems too remote and inaccessible at present to have any effect commercially, but within the next two years certain railroads, now building and nearing completion, will be in operation, after which it would seem good policy to have a survey made.

**SECTION VII. BELLY RIVER ANTICLINAL REGION.**

**DESCRIPTION:** The territory included under this heading is entirely within the plains area and will appear prominently colored blue and marked K-5 on the Geological Map, whereas the most northerly part appears about 50 miles northeast from Edmonton, from where it extends in an irregular southern direction through portions of Alberta and Saskatchewan to the International Boundary.

**HISTORY:** Very fine gas fields have been opened at Medicine Hat, Bow Island and Sweet Grass, and, possibly, one near Viking.

**CONCLUSION:** "To determine that this structural arrangement is favorable for the accumulation of hydro-carbons is easy, because, already, there have been found large gas wells in the different localities above mentioned. The more volatile substance, gas, being more widely diffused, is nearly always discovered earlier than associated oil, and it seems quite logical that oil will be discovered on this general 'Uplift', especially on or along local anticlines."
Sistersville, West Virginia,
June 21st, 1915.

MR. WALTER C. TRagle,
Dominion Bank Building,
Toronto, Canada.

Dear Sir:-

Pursuant with your request and instructions, accompanied
by Mr. George Harrington, I have made an examination of oil and gas
conditions in Alberta, Canada, and respectfully submit the following:

SECTION I. PREFACE.

The time on the ground was about twenty days and, as we
were handicapped by rain and stormy weather at least two-thirds of
that time, of course, it was much too short to make any minute sur-
vey; however, through the use of information and maps, supplied
gratis by the Dominion Government, reports of surveys made by
noted Geologists, from talks with practical men with whom we were
acquainted who were familiar with conditions and free with inform-
ation, and by personal visits to several different regions, we
were enabled to make certain deductions and draw conclusions as
herein set forth. In compiling a report I have included consider-
able detailed information, anticipating it would either be inter-
esting now or would be useful and valuable subsequently for ready
reference and record.

The region covered by this survey and resume is the
whole Province of Alberta and a small part of the eastern portion
of the Province of Saskatchewan. With particular reference to the
large Geological Map furnished by the Dominion Government, which
you will find in the pocket of the cover in which this report is
bound, I made the following divisions and sub-divisions for
practical use to conform generally to geographical, geological
and physical conditions where prospecting has been done, reference
to which will appear in the order as given:

SECTION II. DIVISIONS OF TERRITORY.

1. Foot-hill and Mountainous Region.
   (a) Bingman District.
   (b) Other Districts.
   (c) Conclusion.
2. Western Synclinal Region.
   (a) Miscellaneous Localities.
   (b) Conclusion.

3. Eastern Synclinal Region.
   (a) Miscellaneous Localities.
   (b) Conclusion.

4. Northern Regions.
   (a) Dr. Bosworth's Report.
   (b) Gas at Pelican Falls.
   (c) Fort McMurray.
   (d) Conclusion.

5. Belly River Anticlinal Region.
   (a) Viking.
   (b) Medicine Hat.
   (c) Bow Island.
   (d) Sweet Grass.
   (e) Lancer.
   (f) Conclusion.

(1) SECTION III. FOOT-HILL AND MOUNTAINOUS REGION.

This includes all of the territory along the east flank of the Rocky Mountains lying between the mountains and the western terminus of the plains area, or the herein designated Western Synclinal Region, and, as indicated by the title, topographically, it is hilly and mountainous. In width it would average at least thirty miles. Geologically, the formations are irregular, broken and disturbed, with faults and frequent overfolding. Reference is made herein to:

Mr. George Harrington's Report, pages 94-96.

Review of Mesara. Thompson & Yost's Survey, #1, Oil City District, #3, Dingman District, and #4, Monarch District, pages 90-92.
(a) **DINGMAN DISTRICT.**

**HISTORY:** Reference is made to the map, page 52, for the location of #1 Dingman, the first well drilled, which was started in February, 1913, and completed in May, 1914. A 57 B. gravity oil (See page 28 for analysis) was found at the reported depth of 2716 feet. At no time would this well have yielded more than ten (10) barrels per day, but it was the cause of the boom - "unprecedented even for oil booms" - in Calgary. An account of this boom and frenzied financing of many oil companies in Calgary is given by Mr. Campbell M. Hunter, a prominent Geologist, in a recent periodical, which seems particularly applicable and well written to cover conditions, as it conforms generally to facts verified in many respects by the writer and is, therefore, given, as follows:

"In discussing the oil situation in Calgary as distinguished from the oil prospects of Alberta it is hard to decide whether to treat the subject from a serious point of view or otherwise. This difficulty arises from the extraordinary way in which the Calgary oil boom took possession of the people, and the way the latter allowed themselves to be exploited. Booms are common to every industry, but one has far to seek for such prodigality of effort as was lavished on Calgary last summer (1914) by bogus company promoters and experts notably of the geological variety. To those who were willing to lend themselves and their names to the business, the reward was undoubtedly rich, though probably much of it took the form of worthless scrip. Anyhow, their recollection of the oil craze must be a very different one from that of the unfortunate public who allowed itself to be first mesmerised, then fleeced by financial jugglers and ' eminent' experts. Thus much for the morality of the business.

'Anticlinitis' was Virulent.

"The boom owed its genesis to a happy combination of circumstances, viz., the discovery of an exceptionally high-grade oil accompanied by sufficient gas to cause the well to flow; the irresistible optimism of a credulous people undaunted, though virtually ruined, by a disastrous land boom; the presence of the requisite geological 'talent'; an almost unlimited extent of territory over which oil rights could be secured from the Government at twenty-five cents per acre; and, perhaps, most important of all, an almost total absence of positive surface oil indications. Liberal use was made of these factors by the sponsors of the movement, and
the confusion of the public was rendered more complete by solemn admonitions about the uncertainties of the business on the one hand, followed immediately on the other by the broadcast distribution of prospectuses backed by the same high priests. Lectures, geological and otherwise, but all bearing on the great topic, formed the evening recreation of the people, so that everyone soon felt conversant with oil-field phraseology. Terrestrial vegetational theories curiously concealed in the Kootenay shales became household subjects of conversation. It was not long before anticlines were found everywhere and 'anticlinitis' became as virulent a disease as ever it did in Trinidad or elsewhere. No company dared make its bow to the public without one or more anticlines. Generous recourse was had to the publications of the Canadian Geological Survey, the construction placed on the pronouncements and plans in these reports being often remarkable. One such instance was the discovery by someone of an anticline running at right angles to the well-known Dingman or Turner Valley anticline in such a way as to happily include the properties of the interested parties.

"Most geologists appropriated the data contained in the Government Survey's reports without a word of recognition to their authors; others generously patted the Survey on the back, stating that they were pleased to be able to confirm its conclusions by reason of their own investigations. Unfortunately both categories are now finding themselves face to face with an awkward situation, viz., having to eat their words or hide themselves behind such explanations as unprecedented thickening out of particular strata. It would, of course, be manifestly unfair to accuse geologists of culpable negligence for not studying the geological structure of the properties they were reporting upon, when, for instance, owing to the prospectus having to be printed the next morning there was obviously no time for them personally to visit the properties!

Inducements and Figures.

"From amidst the mass of oil companies' prospectuses one salient feature stands out, namely, the emphasis laid on the number of chances the shareholder stood of striking oil in one or other of several horizons. Thus sometimes one finds the prospect held out of striking oil in the Belly River beds, the Cardium sandstone, while failing these, the Dakota and Kootenay formations offer further probabilities of finding the precious liquid—all within the depth of, say, 4,000 feet, or in one well. The misleading nature of such statements will be appreciated when it is realized that evidence is not lacking that the following thicknesses of strata are probably more nearly correct than the Government Survey's figures, which are given in brackets:
Bearpaw shales (650) up to 1,100 Feet.
Belly River sandstones (650) 2,500 Feet.
Caggetts shales (250) 2,000 (?) Feet.
Cardium sandstones (50) 100 Feet.
Benton shales (725) 3,000 (5,000 ?) Feet.
Dakota sandstones (950) ? Feet.
Kootenay shales (375) ? Feet.

"These values apply to the Foot-hills region running parallel to the Rockies. Owing to the excessive overfolding, accompanied generally by thrust faulting, the apparent thickness of exposed strata cannot always be accepted as correct, especially so in the case of shale formations, since it is very difficult to determine in them the effect of faults, while little aid can be derived from a study of their fossil contents. Another difficulty confronting the geologist is that the formations are not constant in thickness, but thin out as they proceed eastward, and the same has been found to occur in various places in their north and south extension. The Foot-hills zone is characterized by the prevalence of westerly dips; and the frequent repetition of similar beds clearly points to much overfolding. This is particularly marked near the base of the Rockies. Proceeding eastward the overfolding becomes less and less pronounced, giving way to more or less gentle anticlines, until finally the prairie is reached, when the beds become monoclinal. Exceptions to the above are of course to be found, and present interesting studies to anyone with the leisure to devote to them.

Dingman Gas more Valuable than the Oil. "Practically everything of interest about the Dingman well has been published in a variety of forms. Suffice it here to say that the oil is of such a remarkable grade as to justify it being termed a freak oil. More valuable than the oil is the great quantity of rich wet gas that issues from the well and its neighbor, Dingman No. 2. It is truly surprising that so many months have elapsed without a proper gas gasoline compressor being installed for dealing with the gas. But the company has now placed its finances on a strong basis, and its future operations deserve to be watched with great interest. Of all the companies in the field the Calgary Petroleum Products Company, Ltd., is one which has achieved most success, and the honesty of purpose of its management has rendered it free from the imputation of faking returns that has been levelled at so many other concerns in Calgary.
Striking Boom Statistics.

"The following summary shows the approximate position of the Calgary oil industry at the close of 1914:

Number of companies formed, over 500
Nominal capitalization of the companies, nearly $400,000,000.
Total number of wells drilled or drilling, 44
Number of wells:
Under 1,000 ft. in depth, 16
" 1,000 ft. to 1,500 ft. deep, 14
" 2,000 " 2,000 " 5
" 2,500 " 2,500 " 4
" 3,000 " 3,000 " 2
Over 3,000 ft. deep, 3
Aggregate number of feet drilled (approx) 57,000
Number of wells in which oil or gas traces have been reported, 13
Wells in commercial production, i.e., those from which oil or gas is being sold:
Dingman No. 1; Dingman No. 2 (?);
Pincher Creek, Original Discovery Well, No. 1 (?); Moose Mountain (?)

A Faked Sample.

"It is necessary to qualify the statement as to the number of wells in which traces of oil or gas have been recorded by adding that these reports emanated in many instances from interested parties, and, as such, may be open to question. Thus, the writer was asked his opinion of a small sample of oil taken from a well belonging to a company whose shares had soared high on the strength of the alleged strike of oil. The sample was obviously a fake, being nothing more than ground-up lignite mixed with kerosene, the whole being just sufficient to form a thin film on some muddy water in a 4-oz. bottle. (F.C.H. had same experience.) Other wells visited where 'encouraging evidences of oil in increasing quantities were being drawn', or where 'the prospects of the well never looked brighter', or 'the responsible advisers were confident from the appearance of the cuttings and the evidences of oil that the main body of oil would be struck within so many feet'. In practically every case the trip made was in vain.

Canadian Government's New Survey.

"The Canadian Geological Survey is engaged in the preparation of new plans and reports based on the extensive field work which the department carried out last summer. The publication of these bulletins is being awaited with interest, as there is little doubt they will throw fresh light on the question of the oil prospects of Alberta.

"The fact that those who have made years' long study of the Kootenay formations in Western Canada and south of the International Boundary Line are practically unanimous in condemning it as the formation in which to seek for oil will probably give the quietus to the theory with which Calgary was obsessed last year.

"Sandstone lenses in the Benton and Claggett shales, also the Cardium and Lower Belly River sandstones, where disposed under suitable structural con-
ditions, call for close attention. But it must be
conceded that, until definite oil-bearing sands or
horizons have been proven, drilling in new areas
must necessarily be regarded as speculative.

"Less importance must be attached in future
to such statements that, because a property is in
the same district as another on which a well is be-
ing drilled its value is necessarily enhanced there-
by. As a matter of fact, a few feet is often more
than sufficient to ruin the prospects of a well,
especially in the western zone of the Foot-hills
region, i.e., in the region nearest the Rockies,
where the strata are very much folded and faulted.
Greater attention must be paid to the actual struc-
ture of the beds underlying properties; and, where
possible, the true dip of the strata should be giv-
en, as such data throw a valuable side-light on the
depth to which wells may have to be drilled.

Advice to Prospectors.

"Prospectors in search of big pools will be
well advised to shun the intensely over-folded and
broken Foot-hills region which lies nearest the
Rockies. Narrow straggling oil fields may be open-
ed up in that region; on the other hand, the risk
and cost attached to their discovery will generally
be disproportionate to the results they may be ex-
pected to furnish.

"Wells drilled on the more gentle folds of the
middle zone of the Foot-hills will usually require
to be fairly deep, but, when successful, they would
furnish far greater supplies of oil, as the collect-
ing area they will tap is large. Incidentally, few-
er technical difficulties should attach to their
drilling; consequently their cost should not be
notably in excess of the possibly shallower wells in
the more broken ground to the westward.

"Perhaps the strongest and best feature of last
year's oil boom was the remarkable confidence display-
ed by the people of Calgary. Starting the year know-
ing very little about oil, they set themselves to the
task of learning the business with wonderful determi-
nation and enthusiasm. They realized that that mis-
takes would be made and that they would have to pay
for them. Now, however, given even moderate success
in one or two of their ventures, they are game to
carry on the development of their oil and gas re-
sources. But sooner or later financial assistance
must be forthcoming from outside, and one may be per-
mitted the hope that this country will see its way to
come in, once it has been satisfied that the wreckage
of last year has been cleared away."

Many wells were started in the same section, the present
approximate depth of which are shown on the so-called Drilling Re-
port, dated May 20th, 1915, page 52, and the approximate loca-
tion of the wells will appear on the print, page 54. In re-
ference to several of the wells in this district, permit me to re-
repeat substantially as expressed in my letter to you, dated May 31,
1915:

The Alberta Petroleum Consolidated well No. 2 was drilled to a reported depth of 2955 feet, which the drillers reached about March 15th, 1915. At 2774 feet a dark oil was discovered, which is the fluid you had tested and analyzed. (See page 93 herein for analysis). Subsequent to the completion date, a pump was installed and an unsuccessful effort made to pump out the oil. A wire line was used in the place of suckerrods, which it is claimed was the cause of the failure, and now they propose getting suckerrods before trying to operate again. Later the tubing and pump were removed from the well and an estimated total of about seventy-five (75) barrels of oil has been taken out and saved in a steel tank, through the use of a bailer. The steel tank erected is 28 feet in diameter by 12 feet high, with a capacity of about 55,272 U. S. Gallons, or 1300 petroleum barrels of 42 U. S. gallons each. In addition to this, they claim 1200 feet of oil has accumulated in the 8" hole, which would measure approximately seventy-five (75) barrels additionally, so that there would be a total accumulation of about one hundred and fifty (150) barrels during seventy-five (75) days, or two (2) petroleum barrels of 42 U. S. gallons each per day. No doubt, if the well had been pumped or bailed continuously or regularly, there would have been more oil in sight, but the estimate of five (5) to eight (8) barrels per day, as given in my letter of the 26th of May, 1915, still seems sufficiently large to cover the probable initial daily production, and I doubt if it will produce as much as five (5) barrels per day at the end of thirty (30) days' regular pumping operation. I sent you clippings from the daily papers regarding this well, and on page 105 herein is another, all of which will show how unreliable such accounts are in relation to the quantity, quality and value of oil, and, in general, to all matters of fact, so that it would seem best to disregard them hereafter for any practical use.
We spent several hours at the Western Pacific well No. 1, where the drillers were free with information and gave us all we wished to obtain, including a log of the well (See page 57), and samples of oil. A light gravity oil, 47.5, (probably the one you had tested and analyzed, see page 78) was found in hard sand at a depth of 2160 feet and the hole filled up with fluid 400 or 500 feet. This accumulation was bailed out and saved but, after so doing, it seemed to exhaust, so drilling was resumed. A show of heavier oil was found in a sandy shale at 2560 feet, and similar shows in the same formation on down to 2800 feet, the present depth. The quality of this heavier gravity oil appears to be like that from the Alberta Petroleum Consolidated No. 2 and there is only a very small quantity of it, probably less than one (1) barrel per day. According to the drillers, No. 1 Western Pacific will now be cased to shut off a cave and then drilled deeper, but the drillers, who have had experience in Texas, California and other fields, have no faith in the Dingman territory and so expressed their opinion decidedly.

A visit was also made to the Dingman wells. From No. 1 they continue to bail light oil (naphtha) in quantities we estimate to total three (3) to five (5) barrels per day, if bailed regularly, which is disposed of locally for autos, tractors, &c. They have erected three (3) steel tanks (about 200 barrels each) and say they propose to pump the well and store the oil just as soon as suckerrods can be obtained. They tried pumping with a wire line instead of rods, but could not make it work successfully.

It is claimed that the larger portion of this oil comes from a shale formation found at a depth of 2718 feet. There is also a flow of gas from different depths, which we estimate to total 1,000,000 cubic feet per twenty-four hours, some of which is saved and utilized to operate the drilling wells on this and nearby properties. Dingman No. 2 is located about 1100 feet southwest from No. 1. It is about 3100 feet deep; tools have been lost
and they are now fishing. Roughly estimating the dip of the rock from No. 1 to No. 2, it is our opinion it would be necessary to drill to at least 3600 feet at No. 2 to reach the producing horizon found at 2718 feet in No. 1. There is some gas in No. 2 which has a very strong, foul odor, which they claim is "wet" gas and would yield gasoline (liquefied petroleum gas) if properly treated. There were no signs of any oil at this well.

We visited other wells in the same locality but there was no evidence of oil in commercial quantities from any of them, so that the estimated total of eight (8) or ten (10) barrels per day, as hereinabove mentioned, from the Dingman District, is all the production there is in sight at present to show for the several hundred thousand dollars actually expended in prospecting; neither are there good prospects from any wells drilling at various depths, some of which have reached a depth of more than 3,000 feet. Within the past few days I have had word from Mr. Gordon that the Southern Alberta well had struck a sixty-two (62) gravity oil, similar to Dingman, at 3527 feet, and that the fluid has filled up in the hole 800 feet, which would not indicate a well of much value, even if as good as reported, which it probably is not.

It might be interesting to know what prominent Geologists say in relation to this District, as follows:

Dr. O. P. Bosworth: "Regarding the Calgary District, the Dingman or Black Diamond or Okotoks Field, Dr. Bosworth's opinion remains entirely unfavorable, as it has been from the first. In every case in which he has been consulted he has advised against the promotion of companies, against the acquisition of leases and against the drilling of wells. No favorable opinion and no encouragement of any kind has been given by him in any case. The Calgary Field has now been tested by upwards of fifty (50) wells, of which a number have been located by skilled geologists. Probably never has any district, with nothing better to recommend it, been tested so completely."
Campbell M. Hunter: "Prospectors in search of big pools will be well advised to shun the intensely overfolded and broken Foothills region which lies nearest the Rockies. Narrow, straggling oil fields may be opened up in that region. On the other hand, the risk and cost attached to every discovery would generally be disproportionate to the results they may be expected to furnish."

E. H. Cunningham Craig: (It is said of this gentleman that he never passed unfavorably on any field he examined and, according to information received in Calgary, my informant was of the opinion Mr. Craig has received certain encomiums for his work and report. In any event, he is the only person of whom I have heard, outside of the promoters, who has expressed a favorable opinion. Note what he says:

"With regard to wells drilled on the same anticline as the "Discovery" or test called the Dingman well, there is little to be said. Some are situated too far east and some too far west for any prospects and none have reached the necessary depth. The future of this part of the field is still in doubt. There have been many criticisms levelled at it by persons either ill-informed or 'wise after the event', and the Dingman has been only too often spoken of as a 'freak', a frank admission that it is not yet understood. But the carefully considered opinion of geologists is that a body of heavier oil exists somewhere in the neighborhood, and has yet to be discovered. In such cases as this, when many parts of the ground are obscured by drift, and where faulting undoubtedly exists, though not to such an extent as they would have us believe, the wisest course is not to hasten to bless or condemn the field, but to wait patiently for each new piece of authentic information that is brought to light."

The photographs on pages 99 & 100 herein will show some of the structures near No. 1 Dingman. In regard to the Dingman Anticline, Mr. Malcolm M. Thompson gives a very good description in his letter dated September 26th, 1914, page 94, wherein he says:

"The most striking evidence of this fold is that it is more like a inverted V than an arch. The dip is very sharp on both sides of the axis, with practically no flat crest. The structure is very steeply inclined throughout and decidedly broken."

See also rough sketch in Mr. George Harrington's Report, Page 45.
(b) OTHER DISTRICTS.

Under the proper heading, this would include the districts, so-called locally, of Monarch, Mowbray-Berkeley, Cardston, Faber-Mackenzie and Oil City (Pincher Creek). The present status of wells under way in each, excepting the last, will appear on pages 52 & 53, and their locations on print, page 54. We did not visit any of these districts, but made inquiry as to developments and could not learn of anything favorable. The cost of drilling a test well would be the same as in the Dingman District, but, of course, would vary according to depth. An old friend of mine, Mr. W. H. Bickel, formerly of Parkersburg, W. Va., but now located in Calgary, drilled several of the wells by contract, and was very familiar with conditions all through the Province of Alberta. He had no faith in the Pothill region. It is true some oil has been found (See Review of Messrs. Thompson & Yost's Survey by Mr. John Worthington, $1, Oil City, or Pincher Creek, District, pages 76 & 77.), but none in commercial quantities.

(c) CONCLUSION.

We went over the ground carefully in the Dingman District and concluded that CONDITIONS, BOTH GEOLOGICALLY AND PRACTICALLY, ARE DISTINCTLY AND DECIDEDLY UNFAVORABLE FOR OIL PRODUCTION IN COMMERCIAL QUANTITIES:

Geologically unfavorable, on account of the faulty and intense folding of the formations in such a manner that any extensive accumulation of oil or gas seems very improbable; and

Practically unfavorable, because the formations have been penetrated by the drill to a depth of 3,000 feet and over in several different places along and adjacent to the very prominent so-called Dingman Anticline, with no profitable result in any case. The cost of drilling wells in this district to the depth of 3,000 feet has been from $35,000.00 upwards, and the average time to reach that depth about one year. Both expense
and time could probably now be lessened but, in any event, it
would be necessary to obtain an average initial production of at
least fifty (50) barrels per day from each well to justify such
expensive drilling.

It is our opinion that the conclusions expressed
in the three preceding paragraphs may also be applied to any of
the similarly located Foot-hill regions where there has been
prospecting during the past two years, such as Monarch, Nowbray-
Berkeley, Oil City, &c.; and, still farther, generally, to any
of the as yet unexplored Foot-hill regions where the exposed
strata are so badly broken up, disturbed and displaced.

In concluding as set forth, we have been influen-
ced only by facts as they appeared to us, which we used in compari-
son with our experience in, and knowledge of, other fields. It is
possible some new feature may develop, which sometimes occurs
where a small quantity of oil and gas is found, so it would un-
doubtedly be good policy to employ "safety first" methods and con-
tinue to watch developments closely. However, as of date, every-
thing is unquestionably and decidedly negative. Some oil may, and
probably will, be found, but never in substantial and paying quan-
tities is our prediction.

(2) SECTION IV. WESTERN SYCLINAL REGION.

This includes the territory adjacent to and east of the
Foot-hills Region, extending from the International Boundary
northward and practically parallel with the Rocky Mountains for a
distance of about five hundred (500) miles to a point northwest
of Edmonton. Its width is limited by the Foot-hills Region here-
before described, on the west, and the Belly River Anticlinal
Region, on the east. The latter appears prominently colored blue
and marked K-5 on the Dominion Geological Map enclosed in the
pocket herewith. In Mr. George Harrington's report he gives a
description of the regions I have herein designated as Western Synclinal and Belly River, under one heading as the Treeless Plains, Section _____, page 46.

(a) MISCELLANEOUS LOCALITIES.

Within the limits of the so-called Synclinal Regions several dry holes have been drilled, of which we did not have knowledge when I wrote you under date of May 31st, 1915. We made many inquiries and finally learned of the following:

Two dry holes, located 30 to 40 miles northwest of Edmonton, one of which was drilled to the depth of 3,000 feet.

One well near Toefield, which is a small town on the Grand Trunk Pacific Railway about 40 miles east from Edmonton. This well had some gas, but the flow soon exhausted and the well has been abandoned.

One well near Camrose, about 40 miles southeast of Edmonton. Some gas reported, but not in paying quantities, and well has been abandoned, according to Mr. W. H. Bickel.

One well near Castor, located about 110 miles southeast of Edmonton. Some gas reported, but flow soon exhausted and well has been abandoned, according to Mr. W. H. Bickel.

We could not ascertain the depths of the above mentioned wells, but understood some of them were in excess of 2,000 feet. Undoubtedly, other wells have been drilled within this region, but very few.

The Drilling Report will show two wells under way in this region (Federal and High River, page 53), which should prove interesting tests and I asked your Mr. P. W. Gordon to keep you posted as to results.

(b) CONCLUSION.

Being a Synclinal Region, it is the writer's opinion that conditions generally would not be favorable for either oil or gas production in commercial quantities. Possibly oil or gas
in paying quantities may be found in some local fold as yet undiscovered in this Synclinal Region, but to determine whether there are local folds, anticlinals or places geologically favorable for finding pools of oil or gas therein would require much study and detailed structural investigation. The whole country seems to have been carefully searched by many geologists during the boom and, to our knowledge, no such favorable structures have been found, so it would seem rather improbable that any exist.

You had in mind it possibly might be a good plan for the Imperial Oil Company to obtain leases east of the Dingman or foothills Region toward Okotoks. The cost of obtaining leases, the major portion of which have been filed on, added to the cost of drilling a well, would approximate at least $30,000.00. Considering this feature and those set forth in the preceding paragraphs, we doubt if it would be good policy to do anything at this time; in fact, we would advise against further consideration of the project at the present time.

(3) SECTION V. EASTERN SYNCLINAL REGION.
Extending eastward from the herein designated Belly River Anticlinal Region is a broad, shallow, structural basin, as shown on the Geological Map and drawing attached thereto, whereon its description and limits appear sufficiently plain for any use herein.

(a) MISCELLANEOUS LOCALITIES.
Wells have been drilled as follows:
One dry hole to the depth of 2600 feet near Swift Current, Saskatchewan. Shales all the way with a few light shows of gas at various depths, according to Mr. W. H. Bickel, Drilling Contractor.

One dry hole to the depth of 3300 feet near Moose Jaw, Sas-
The location of Lancer is given on Page 31.

On compiling my report from notes and giving consideration to the two districts - Eastern Synclinal and Belly River - separately, I was under the impression that there was a place of that name near Regina. The note on page 19 is O.K. in regard to operations, but Lancer should not be included in the Eastern Synclinal Region as it is within the Belly River Region, as set forth on page 31. Probably Mr. Caste is figuring on piping the gas to Regina and Moose Jaw in case he can find and produce it in adequate quantities.

July 12th., 1915.

[Signature]
Katchewan. Large volume of water found near 2300 feet. Light shows of gas at various depths.

We were informed that Mr. Eugene Coote had obtained a Natural Gas Franchise from the city of Regina, Saskatchewan, and will drill for gas near Lancer. We were also informed that he had lately drilled one well near the latter place to the depth of 300 feet, but that it was now shut down; also that he had two more rigs completed in the same vicinity but had not started drilling.

(b) CONCLUSION.

In speaking of this region, under the heading of Saskatchewan Syncline, on page 49 herein, Mr. George Harrington writes:

"The southern part of the Province of Saskatchewan, eastward from the above described arch, is a broad, shallow, structural basin. It is possible that terraces or local anticlines may be discovered, especially on the western slope of this broad syncline, but they would be difficult to find on account of the flat prairie topography with but few rock exposures, but that such should exist seems not very probable because it is far removed from mountains or other regions of strata disturbance".

which is to indicate that, being a synclinal region, conditions generally are not favorable for either oil or gas in commercial quantities.

(4) SECTION VI. NORTHERN REGIONS.

The territory within this so-called division seems sufficiently described and located under the headings of "Muskeg Plateau" and "Great Slave Lake and Mackenzie River" in Mr. George Harrington's Report, pages 49 and 50 herein. Of course, you will understand that we did not have an opportunity to visit any of this country.

(a) DR. T. O. BOSWORTH'S REPORT.

This prominent Geologist, who made a personal survey of the different localities mentioned, seems to have been favorably impressed, and writes:
katchewan. Large volume of water found near 3300 feet. Light shows of gas at various depths.

We were informed that Mr. Eugene Coste had obtained a Natural Gas Franchise from the city of Regina, Saskatchewan, and will drill for gas near Lancer. We were also informed that he had lately drilled one well near the latter place to the depth of 300 feet, but that it was now shut down; also that he had two more rigs completed in the same vicinity but had not started drilling.

(b) CONCLUSION.

The location of Lancer is given on Page 31.

On compiling my report from notes and giving consideration to the two districts - Eastern

Synclinal and Belly River - separately, I was under the impression that there was a place of that name near Regina. The note on page 19 is O.K. in regard to operations, but Lancer should not be included in the Eastern Synclinal Region as it is within the Belly River Region, as set forth on page 31.

Probably Mr. Coste is figuring on piping the gas to Regina and Moose Jaw in case he can find and produce it in adequate quantities.

July 18th., 1915.

The territory within this so-called division seems sufficiently described and located under the headings of "Muskog Plateau" and "Great Slave Lake and Mackenzie River" in Mr. George Harrington's Report, pages 49 and 50 herein. Of course, you will understand that we did not have an opportunity to visit any of this country.

(a) DR. T. O. BOSWORTH'S REPORT.

This prominent Geologist, who made a personal survey of the different localities mentioned, seems to have been favorably impressed, and writes:
"NORTHERN ALBERTA - THE TAR SAND REGION."

"In the northern half of Alberta the surface is occupied in part by almost flat-lying Cretaceous deposits, and in part by outcroppings of Devonian and Archaean rocks from which the Cretaceous cover has been demolded.

"In several districts north of Edmonton exploitation has been attempted during the past year in the Cretaceous formation; and the Calgary boom was promptly followed by a boom in Edmonton and a rush to the Land Office to file oil leases in three or four alleged oil fields north of Edmonton. The results have been negligible, except that a heavy strike of gas was met with in a well near Edmonton.

"There is, however, 350 miles further north, a region of extraordinary interest and importance - the Tar Sand region of the Athabasca River.

"Often the tar sands of the Athabasca are referred to in print; but they have as yet been visited by but few experienced geologists. Up to the present time they have been difficult of access, as they are separated from the northern terminus of the railroad systems by some 150 miles of thick forest, and the only road to them is by way of the winding river with its ninety miles of dangerous rapids.

"This is not the time and place to deal with the results of the work, but some bare facts which can be mentioned may prove interesting.

"The tar sand bed forms cliffs sometimes 200 feet or more in height and is exposed for about 100 miles along the Athabasca River, resting unconformably on a floor of Devonian Limestone.

"The tar sand is the basal member of the Cretaceous system, and is a sandstone formation more or less completely saturated with heavy oil. It is almost wholly black and plastic, though its surface weathered to a pale color in the cliffs.

"This great sheet of asphaltic rock is evidently present over an area of 2,000 square miles, and probably it extends over as much as 10,000 square miles.

"Experiments by the writer show that it contains some 14 gallons of petroleum per ton, of which a considerable portion is gasoline (petrol).

"The exposure of asphaltum visible along this river is greater than all the other known asphaltic outcrops, pitch lakes and oil seepages in the world put together.

"The amount of petroleum in this tar sand, presuming the bed to extend over 10,000 square miles, and if it be constant in character, must be near 200,000 million tons! That is to say, sufficient to satisfy the world's demand (at present rate) for 2,000 years.

"The tar sand is overlain by various other divisions of the Cretaceous, and to the southward it dips away beneath them out of sight."
"The sequence of strata in this region is as follows:

<table>
<thead>
<tr>
<th>Formation</th>
<th>Feet</th>
</tr>
</thead>
<tbody>
<tr>
<td>La Biche shales</td>
<td></td>
</tr>
<tr>
<td>Pelican sandstone</td>
<td>40</td>
</tr>
<tr>
<td>Pelican shale</td>
<td>100</td>
</tr>
<tr>
<td>Grand Rapid sandstone</td>
<td>300</td>
</tr>
<tr>
<td>Clearwater shales</td>
<td>200</td>
</tr>
<tr>
<td>The Tar Sands</td>
<td>220</td>
</tr>
</tbody>
</table>

Cretaceous

Devonian

"Where the tar sand passes underground extensive seepages of gas occur. Travellers camping at these places cook their food over the gas vents. In some places on the river, where the tar sand lies a few hundred feet beneath, the gas is bubbling up in an extraordinary amount, so that innumerable bubbles disturb the water over half an acre or more."

"Several wells have been drilled recently in this southern part of the Athabasca River, and large quantities of gas are issuing from them. There is undoubtedly an important gas field in this region.

"The oldest wells are three which were drilled by the Government, 1894 to 1898, all of which struck gas. One of these wells struck a flow of gas so great that the noise of it could be heard two miles away, and a large flow is issuing to this day. Tar rock was reached at 1750 feet and was penetrated to a depth of 97 feet; further drilling was found impossible on account of the thick tar forced up by the gas.

"In the northern part of the Athabasca River some fifteen wells have been drilled, but almost all of them started in the Devonian limestone. Some went down to 1,500 feet without success, but several wells have been drilled in the outcrop of the tar sand and have obtained oil in the first 200 feet. The oil is black, and so viscous that it cannot be pumped out. Its composition is quite peculiar; on distillation it yielded:

5 per cent. gasoline (petrol or motor spirit)
60 " kerosene.
15 " lubricating oil.
20 " coke, etc.

"The writer's findings and conclusions as to the nature and source of the asphaltic material in the tar sand and the mining prospects cannot here be discussed — though it may be mentioned that, in his opinion, the proper exploitation of the Tar Sand region may be considered as not yet commenced."

"THE NORTH-WEST TERRITORY, TOGETHER
WITH A PART OF NORTHERN ALBERTA."

"The most conspicuous surface showings of fluid petroleum yet discovered in Canada occur in the North-West Territory.

"These regions are remote from civilization and are covered by dense forest and muskeg; but a waterway to them is provided by the great drainage system of the Mackenzie. Flowing through northern Alberta towards the north are two large rivers, the Peace River and the Athabasca River, and these unite and form the Slave River, which flows on into the Great Slave Lake and thence onward to the Arctic Ocean as the Mackenzie River."
"By water the distance from the railroad terminus at Athabasca Landing to the Arctic Ocean is about 1800 miles.

The writer has spent a large part of the past year conducting oil explorations throughout the territories bordering these waterways. Several geological parties were engaged in the work and thus very extensive areas were examined. With regard to the essential features of the geology, the findings in the main confirm the observations of Mr. W. G. McConnell, of the Canadian Geological Survey, who traversed the region in 1937.

"Geological Structure.

"In the north of Alberta, in the valleys of the Peace River and Athabasca River, the Devonian formation comes into view beneath the Cretaceous rocks, and, as we proceed northward, the Devonian becomes more and more exposed, until at length we pass into a wide region of Devonian rocks in which any coverings of newer formations are few and far between.

"The area occupied by the Devonian must be some 200,000 square miles in extent, reaching from the Peace River and Athabasca River to the Arctic Ocean.

"In the south the strata are gently undulated, but, away in the distant north a system of great folds occurs.

"The Devonian is of great thickness and comprises many interesting sub-divisions (which will be discussed at some future date). Only a very small portion of the formation is exposed in the country south of the Great Slave Lake, and that consists mainly of compact fossiliferous limestone. It is unwise for any oil men to attempt to judge of this formation from the little that is there exposed.

"The source of the oil is a bituminous shale, several hundred feet in thickness, which is associated also with several hundred feet of bituminous limestone. The shale contains palaeozoic plants.

"From these rocks oil has been naturally developed and is accumulated in overlying sand formations and porous dolomites.

"The Oil Indications.

"The black bituminous shales often are quite hot and in many places are burning. In several localities the writer found cliffs 100 to 200 feet high composed of these rocks burnt to a bright brick-red color.

"In a number of places, on the Mackenzie, light oil was observed seeping into the water in considerable quantity for a distance of several miles along the river side. This oil has been collected in bottles and burned in lamps.

"Further inland there are deposits of asphaltum and thick oil, which is used by the Indians for their canoes.

"On the shores of the Great Slave Lake in certain localities there are copious seepages of asphaltic oil and tar deposits.

"For miles along the shore much oil is trickling into the lake.

"Many tins and bottles full of oil were brought back from these places by the author."
"It is not intended to treat of the prospects in these regions now, nor to enter into any of the particulars; but probably enough has been said to show that oil is abundantly present in certain regions and that the oil belongs to the Devonian formation.

(b) GAS AT FELICAN FALLS.

From my letter to you, under date of the 3rd instant, I quote:

"You are aware that this is a hard place to reach and, as there seemed no necessity, we decided not to make the trip. The information contained herein regarding the country was obtained from some of the interested persons, which we verified when possible, and from which we made deductions. There are three gas wells located near Pelican Falls, about 100 miles north from Edmonton. The depth of the wells is from 700 to 900 feet. The maximum rock pressure is about 2200 and the total volume from the three wells combined is not to exceed 6,000,000 cubic feet. The Northern Alberta Natural Gas & Development Company have a large area under lease and, according to report, the major portion of the remaining favorably located nearby acreage has been filed on. In this same locality the Dominion Government drilled a well fifteen or more years ago and had a large flow of gas. (See page 40 herein for log of same). The well was abandoned but the flow still continues sufficient to make a flame of considerable size."

(c) FORT MCMURRAY.

In this vicinity and on down the Athabasca River, not less than twelve (12) wells have been drilled in which oil has been discovered, but, in the absence of any reports to the contrary, information led us to conclude the nature of same was "seepage" from the Tar Sands, and the oil of a low gravity in small quantities. Reference is made to the above quotation from Dr. T. C. Bosworth's personal survey, Mr. George Harrington's Report, pages 49 and 50, also to copy of letter from Malcolm E. Davis & Company, pages 95 to 97, wherein particular reference is made to several of the wells and the analyses of the oil.
Further reference is made to Memoirs No. 29-3, pages 56 to 61, inclusive, which gives some information regarding this country. (We had this book on our trip but in some manner either mislaid or lost our copy, so had to compile the report without it. Unfortunately, it is now out of print and the copy just received from you, and returned herewith, is the only one there will be. It contains some interesting information in regard to practically all the districts herein mentioned).

(d) CONCLUSION.

The places mentioned herein seem too remote and inaccessible at present to have any effect commercially, even though oil and gas could be discovered and produced in substantial quantities, which, of course, is still doubtful; however, within the next two years, certain railroads, now building and nearing completion, will be in operation, after which it would seem good policy to have a survey made.

(5) SECTION VII. BELLY RIVER ANTICLINAL REGION.

The territory embraced under this heading will appear prominently colored blue and marked X-5 on the Geological Map, whereon the most northerly point appears about 50 miles north-east from Edmonton, from where it extends in an irregular southerly direction through portions of Alberta and Saskatchewan to the International Boundary.

For a further description, topographically and geologically, see Mr. George Harrington's Report, pages 46 to 49, inclusive, wherein he writes under the captions of the "Treeless Southern Plains", "Viking", "Kindersley" and "Medicine Hat, Bow Island and Sweet Grass".

All the districts mentioned under this heading appear on the "Uplift" and it is interesting to note that all the wells produce gas in substantial quantities.
(a) **VIKING.**

This small town is located on the Grand Trunk Pacific Railway about 80 miles southeast from Edmonton, and the object of our visit, as per your instructions, was to examine the gas well located near the town and consider the same in connection with a Natural Gas Franchise for the City of Edmonton. When we arrived at the latter place we found the city about ready to vote on granting a franchise to other parties, which accounts for some parts of my report to you from Calgary, dated the 3rd instant, from which I quote substantially for the purpose of record to cover both the franchise matter and the calibre of the Viking well:

"Yesterday I wired you, 'Edmonton citizens will vote next Monday on granting exclusive natural gas franchise to combination of firms having some gas Pelican Falls and Viking, neither of whom have adequate supply as yet, without which granting of such franchise is bad policy'. I now question the advisability of having sent this, but, at the time, I did not know how deeply you might be interested, or whether you had previously had the information. Your letter of the 20th ultimo indicated you had some considerable interest, and should you have wishes to make use of the information it was necessary to wire instead of writing.

"The people of Edmonton are much worked up over the election in connection with the natural gas franchise. An issue of the Edmonton Journal containing the By-Law or Franchise Agreement, also other papers with editorials and comment thereon, accompany this report in the pocket attached to the cover. The gas company is working diligently to influence public opinion favorably, as some of their advertisements in papers sent will indicate. There is talk of Bank of Montreal and J. Pierpoint Morgan financial backing but this would smell of 'fish' and I surmise it is all more or less another promotion and stock jobbing affair, for it figures out much the same as refineries, pipe-lines, tankage and sales of refined product schemes in connection with Calgary and Dingman oil before they have any crude. The promoters are wise, of course, being 'Fast Masters' at the game, but the innocent purchasers of stock seem to entirely overlook the absolutely necessary and essential feature that you must have an adequate supply of gas or crude oil before you can have any substantial value. Neither do they realize that to procure this adequate supply, it is the hardest, most doubtful, expensive and hazardous part of the business. Boiled down and briefly covered, the whole proposition appears to be substantially as follows:
"Previously, the granting of a natural gas franchise has twice been before the people and was turned down both times. There seemed to be one faction, with gas holdings at Pelican Falls, who favored private ownership, and another, with interests at Viking, who preferred municipal ownership. It is reported that these two factions have combined and that both are now in favor of, and are working for, the new franchise. Many of the citizens with whom we talked thought the people would approve granting the new, exclusive franchise, and if so, this will bar other persons from giving much consideration to any similar project for Edmonton during the next two years.

"With the franchise and a little gas in sight the Northern Alberta Natural Gas & Development Co., Ltd., will no doubt be able to sell sufficient stock to do more drilling, after which, if they obtain more gas, more stock or bonds can be sold, and possibly enough money secured to satisfy the greed of the promoters and complete the plant. In any event, the promoters win.

"Regarding the amount of gas at Viking: There is only one well, which is located 3 miles north of Viking and was drilled by the Edmonton Industrial Association who commenced work in May, 1914, and completed the drilling to a depth of 2240 feet about November 1st of the same year. Some gas was found at different depths but the greater flow and the only drilling was suspended at 2240 feet. Various estimates have been given as to the amount of gas, from public records of thorough tests, filed in opposition against the City of Edmonton, and appearing in the Edmonton Journal, November, 1914, by men we infer were connected with the company. The approximate true production per 24 consecutive hours after blow was 1275 cubic feet. The following was received after Report has been compiled:

C.R.

NORTHERN (THE) ALBERTA NATURAL GAS DEVELOPMENT CO. LTD. - - - -

EDMONTON, A L T A.

20700-3-June 11th, 1915:

Incorporated under Alberta Laws March 31st, 1915, with an authorized capital of $500,000 divided into 5,000 shares of $100 each. Incorporators were: R. E. Engelhausen, Student at Law, H. C. Grainger, one share, A. Edmond, one share. These parties were only the incorporators and have nothing whatever to do with the company.

The company was formed for the purpose of securing the Natural Gas Franchise from the City, and one E. H. Hyndman, who is a local barrister, was apparently the agent for the company at this point.

The company claimed that if they were successful in getting the franchise, they would invest $4,500,000, and A. E. Jackson, Capitalist, S. H. Smith, Capitalist, Alfred Driscoll, Dominion Land Surveyor, John Welmer, Lumber Merchant, and H. L. Williams, Oil Magnate, were to be identified with the company, and it is understood that considerable outside capital would be interested.

However, the Vote came before the public on June 7th, 1915, and the proposition was voted down. It is not thought that the company will make any further attempt to secure the franchise.

The officers and directors of the company have not been published.

12-6-11-15. 14100-342. -/-
"Previously, the granting of a natural gas franchise has twice been before the people and was turned down both times. There seemed to be one faction, with gas holdings at Pelican Falls, who favored private ownership, and another, with interests at Viking, who preferred municipal ownership. It is reported that these two factions have combined and that both are now in favor of, and are working for, the new franchise. Many of the citizens with whom we talked thought the people would approve granting the new, exclusive franchise, and if so, this will bar other persons from giving much consideration to any similar project for Edmonton during the next two years.

"With the franchise and a little gas in sight the Northern Alberta Natural Gas & Development Co., Ltd., will, no doubt, be able to sell sufficient stock to do more drilling, after which, if they obtain more gas, more stock or bonds can be sold, and possibly enough money secured to satisfy the greed of the promoters and complete the plant. In any event, the promoters win.

"Regarding the amount of gas at Viking: There is only one well, which is located 5 miles north of Viking and was drilled by The Edmonton Industrial Association who commenced work in May, 1914, and completed the drilling to a depth of 2,340 feet about November 1st of the same year. Some gas was found at different depths but the greater flow and the only one of value, commercially, was found just before drilling was suspended at 2,340 feet. Various estimates have been given out as to the amount of gas, but from public records of thorough tests, filed in connection with a claim of The Industrial Association against the City of Edmonton, made during November, 1914, by men we infer were competent, it appeared the Maximum Rock Pressure was 274 pounds per square inch, the approximate true volume, 2,000,000 cubic feet per 24 hours after blowing open for seven days. When first drilled in, reports would lead one to believe the well had more gas. The official test figures are given as follows:

<table>
<thead>
<tr>
<th>Date</th>
<th>Open 1 hour</th>
<th>Cu. Ft.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nov. 14/14</td>
<td>4,320,000</td>
<td></td>
</tr>
<tr>
<td>Nov. 15</td>
<td>5,500,000</td>
<td></td>
</tr>
<tr>
<td>Nov. 16</td>
<td>5,180,000</td>
<td></td>
</tr>
<tr>
<td>Nov. 17</td>
<td>2,760,000</td>
<td></td>
</tr>
<tr>
<td>Nov. 18</td>
<td>2,590,000</td>
<td></td>
</tr>
<tr>
<td>Nov. 19</td>
<td>2,350,000</td>
<td></td>
</tr>
<tr>
<td>Nov. 20</td>
<td>2,000,000</td>
<td></td>
</tr>
<tr>
<td>Nov. 21</td>
<td>1,930,000</td>
<td></td>
</tr>
</tbody>
</table>

"It is also recorded that a Chemical Test by Jas. A. Koelso, Chemical Engineer, was made and results were:

- Carbon Dioxide 0.6 per cent.
- Illuminants 0.1
- Oxygen 0.4
- Hydrogen 0.0
- Carbon Monoxide 0.6
- Paraffin Hydrocarbons 93.3
- Nitrogen 5.0
- Sulfured Hydrogen 0.0

from which the heating value was calculated to be 1000 B.T.U.
The following was received after Report had been compiled:

C.R.

NORTHERN (THE) ALBERTA NATURAL GAS DEVELOPMENT CO. LTD. ———

EDMONTON, A L T A.

20700-3—June 11th, 1915:

Incorporated under Alberta Laws March 31st, 1915, with an authorized capital of $500,000 divided into 5,000 shares of $100 each. Incorporators were: E. T. Engelhausen, Student at Law, H. O. Grainger, one share, A. Edmond, one share. These parties were only the incorporators and have nothing whatever to do with the company.

The company was formed for the purpose of securing the Natural Gas Franchise from the City, and one H. H. Hyndman, who is a local barrister, was apparently the agent for the company at this point.

The company claimed that if they were successful in getting the franchise, they would invest $4,500,000, and A. E. Jackson, Capitalist, S. H. Smith, Capitalist, Alfred Driscoll, Dominion Land Surveyor, John Welter, Lumber Merchant, and H. L. Williams, Oil Magnate, were to be identified with the company, and it is understood that considerable outside capital would be interested.

However, the vote came before the public on June 7th, 1915, and the proposition was voted down. It is not thought that the company will make any further attempt to secure the franchise.

The officers and directors of the company have not been published.

12-6-11-15. 14100-342. —/-
"We were at the well on the 1st instant and
found it had been drilled with a good outfit, also
that everything seemed to be in good shape and the
gas shut in. Information more in detail will come
with our final report and it seems only necessary
to add herein that we were not very favorably im-
pressed on account of the low rock pressure and
the rapid decrease of the volume during the seven
day test. For practical purposes of supply in a
line to Edmonton, the Viking well would not de-
liver more than 500,000 cu. feet per day, and it
would seem necessary to have not less than 20 ad-
ditional wells equally as good before one would be
justified in installing a complete plant for Edmon-
ton.

"Thru the kindness of Mr. J. A. Boyd, of Ed-
monton, we were enabled to make good use of our
time while in his city, and further were advised
that the completion of the Viking well had cost
about $25,000.00; that the Association only had
100 acres under lease, and also that not much of
the surrounding territory had been taken up for
oil and gas purposes.

"Concerning the source of supply from the
vicinity of Pelican Rapids: You are aware that
this is a hard place to reach, and as there seemed
no necessity, we decided not to make the trip.
The information contained herein regarding that
country was obtained from some of the interested
persons, which we verified when possible and from
which we made deductions. There are three gas
wells located near place mentioned, about 180
miles north from Edmonton. The depth of the wells
is from 700 to 900 feet; the Maximum Rock Pres-
sure is about 290#, and the total volume from the
three wells combined is not to exceed 6,000,000
cu. feet. The Northern Alberta Natural Gas &
Development Co. have a large area under lease, and,
according to report, the major portion of the re-
mainning favorably located nearby acreage has been
ruled on. In this same locality the Dominion Gov-
ernment drilled a well 16 or more years ago and
had a large flow of gas. The well was abandoned
but the flow still continues sufficient to make a
flame of considerable size.

"Judging from all reports, the Pelican Falls
Region will probably be productive of gas, but when
considered at present as a source of supply for Ed-
monton, it is our opinion it is not feasible on ac-
count of the present light supply, the low rock
pressure, the small flow from each well, the dis-
tance from a railroad, and the distance from market.

"Relative to cost of installing a complete nat-
ural gas plant for Edmonton, the following estimates
are rough but very conservative:

- If from Viking: Cost of developing territory
  and obtaining an adequate supply of gas - if same is
  there -
  80 wells at $15,000.00.................. $300,000.00
  Pump Station to provide pressure to
  force gas to market................... 500,000.00
  80 miles main line at $16,000 per mile, 1,200,000.00
  Piping the City,......................... 500,000.00

Total, $2,500,000.00
"If from Pelican Falls: Add 100 miles Main Line at $15,000.00 per mile, or $1,500,000, which would give a total of $4,000,000.

"In either event, it would be necessary to know you had or were assured of an dependable supply of gas before the project would warrant serious consideration."

I afterwards had word that the vote stood 7864 for and 5265 against, lacking 892 votes for the necessary two-third's majority and, therefore, the franchise was turned down.

Possibly my letter does not give emphasis to the fact that we were very skeptical as to the value of the Viking well. The rock pressure is much too low for the depth, and this, coupled with the fact that the volume has declined rapidly, (See sample of sand from which the well produces gas, in pocket of cover.)

While we were at Viking we made inquiries as to other wells completed or under way in that locality, and learned of only two, as follows:

One dry hole near Vegereville, located about 30 miles north from Viking. Question as to depth, but report indicated some gas - not enough to pay for saving. (We could not verify this information).

One well drilling at depth of 900 feet, located near Erma, 30 miles southeast from Viking. Nothing favorable so far. This is an interesting test and it would seem good policy to keep tab on it.

(b) MEDICINE HAT.

Within the city limits and close about the town twenty-four (24) wells (See print, page 55, for locations.) have been drilled, all of which have produced good dry gas in substantial quantities from an average depth of about 900 feet below creek or river level, the volume ranging from 1,500,000 to 5,000,000 cubic feet - generally about 2,000,000 cubic feet - with an initial maximum rock pressure of not less than 500 psi. Seventeen (17) of the wells were drilled by the City and four were transferred to
certain industrial plants; five were drilled and are now being operated by a large Cement Works; two were drilled and are operated by the C. P. Railway for their local shops. The gas is all used locally. There is an abundant supply for all purposes and, having been used for several years without showing more than ordinary exhaustion, it seems safe to predict long life. (See "Booster" pamphlet, compiled and put out by the Medicine Hat Board of Trade, page 104 herein). Reference is also made to Well Records, pages 62 to 64, inclusive.

West of Medicine Hat, along the C. P. Railway, gas wells somewhat similar to those at the Hat and in the same formation (depth is greater on account of surface elevation) have been found at the following places:

Redcliff, six, and possibly more, wells.
Suffield, three wells.
Brooks, two wells.

According to the information obtained, the wells at Brooks and Suffield have smaller volume than those at Medicine Hat and Redcliff. In all instances of which we could obtain knowledge, the gas was dry - no water - where properly drilled, cased and operated, and there were no oil showings.

A well, now drilling near the Hat, Section 5, Township 13, Range 5, will drill below the gas and to a much greater depth, if possible, to ascertain if there is oil or gas in the lower formations. This is another interesting test, and probably it would be best to keep an eye on it.

(c) **BOW ISLAND.**

This is a small town, located about 40 miles west from Medicine Hat on the C. P. Railway, in the vicinity of which seventeen (17) wells (See page 86 for location) have been drilled and all have proven good gas wells, producing from a depth of about 1900 feet below creek or river level. The volume of the
gas ranges from 2,000,000 to 28,000,000 cubic feet per day, and, judging from information obtained from Mr. Bickel, who drilled several of them, the average per well would be about 10,000,000 cubic feet per day. The maximum initial rock pressure was reported not less than 900$. The gas is found in a Sandstone formation and, while I have been unable to obtain a log of one or two of the wells, I am expecting one daily from Mr. Bickel; however, you will find a log of one of the wells. page 65. herein, which we copied from Memoir No. 29-B.

These wells were completed subsequent to April, 1911, and are operated by a syndicate, of which Mr. Eugene Coste is the head. The gas is piped to Calgary through about 180 miles of 16" (?) line, where the Calgary Gas Company sell it for the following prices:

First  150,000 cu.ft.  35¢. Net.
Next  850,000 "  30¢. "  25¢.
Next  1,000,000 "  25¢. "  20¢.
Next  5,000,000 "  20¢. "  15¢.

Some of the wells have lately commenced showing Salt water but, whether this is an indication of exhaustion, or improper drilling, casing and operation, we could not ascertain; however, probably one of the latter, since water is frequently found just below, and sometimes above, the gas. No shows or indications of oil were encountered in any of the wells. Neither has there been any dry holes drilled in this locality.

(d) SWEET GRASS.

Thirty-five miles south from Bow Island, the United Oil Company are drilling a well in Section 30, Township 5, Range 10, (See print, page 56, for location). When we visited this well we found it 2270 feet deep and flowing about 12,000,000 cubic feet of gas and 5,000 barrels of salt water per day. (See Log and Record of Drilling, pages 66-67). This well is being
drilled by Mr. W. H. Bickel, Contractor. (See photos, page 102). The gas is from the same formation as that found near Bow Island and, although the rock pressure had not been tested, it appeared and was estimated to be greater than at Bow Island. (See sample of sand from which the gas comes, in pocket of cover).

It is interesting to note that in connection with this latter well they had a wireless operator with an outfit in operation, also an expert geologist in almost constant attendance, both of which are not uncommon in connection with prospect wells in Alberta since the Dingman fiasco.

Further south, other wells are drilling, as shown on the Drilling Report, page 53, and see also print, page 56, for locations.

(e) **LANCER.**

Northeast of Medicine Hat about 80 miles, we heard of a rig up or a well drilling near Lancer, but could not obtain any information. If there is a well drilling, it would be very interesting to know the results.

(f) **CONCLUSION.**

So far as we could learn, EVERY WELL LOCATED AND DRILLED ON THIS BELLY RIVER "UPLIFT" HAD PRODUCED GAS IN SUBSTANTIAL QUANTITIES. Judging from present indications, the field or fields cover an area of good size, so that there will be an abundant supply for years to come. At present, it has value only for use locally, as mentioned above, and, until the country is more thickly populated, which will probably not be soon, it would be impossible to attach any considerable commercial value to the gas, for where and how could one dispose of or utilize it profitably?

Aside from the gas feature, and, considered as a prospective oil field, it has the following to recommend it:
Geologically, conditions seem to the writer just as favorable, and even more so than where fields have been developed in the United States. Mr. George Harrington had noted geological conditions and has had experience with practical features in the fields of Pennsylvania, West Virginia, Ohio, Louisiana, Texas, Kansas, Oklahoma, Wyoming and Mexico. In his Report, page 48, he writes:

"To determine that this structural arrangement is favorable for the accumulation of hydro-carbons is easy, because, already, there have been found large gas wells in three different localities: Medicine Hat, Bow Island and Sweet Grass. The more volatile substance, gas, being more widely diffused, is nearly always discovered earlier than associated oil, and it seems quite logical that oil will be discovered on this general Uplift, especially on or along local anticlines."

The writer, in a recent letter, expressed a similar opinion, as follows:

"While I did not find anything indicative of a substantial oil production in the near future, there were some fine gas wells and a large area seems to be underlaid with a large volume of gas, held under good pressure. A practical oil man generally accepts this as a very favorable sign for oil not far away, since such has been his experience in fields throughout the United States". This is based on knowledge of several fields where gas underlaid large areas, the wells had good volume and the gas was held under high pressure; in fact, I do not know of any such field where oil in substantial quantities was not sooner or later discovered.
Those who have previously made an examination on the ground of conditions in connection with the Belly River "Uplift" and the local folds thereon have made prominent mention of great gas possibilities, which are self-evident, but, for some reason, have said very little about oil, either favorable or otherwise. Possibly there may be some reasons for this but, in the absence of anything to off-set, I believe the majority of practical oil men would apply the same rule of experience. And late accumulations of large tracts of land and the commencement of wells in the Sweet Grass District would indicate that others - theoretical and practical - are of the same opinion.

Assuming that there is oil there, one must well consider the hazard of finding it as compared with his finances. A small map is deceiving and one would hardly believe that a line drawn across the "Uplift" east and west through Medicine Hat would cut off and leave to the south about 6,640 square miles, shown on the map as being in the Belly River Anticlinal Region. North of Medicine Hat, and shown as being in the same region, roughly estimated, there would be three times as many square miles, or a total of 27,360 square miles in the whole region. To commence now and look for oil in this region would be similar to looking for the proverbial needle in the haystack. In addition to this, the necessity of operation in connection with the terms of leases and the excessive cost of so doing, would make the project even more than extra hazardous, so I am inclined to think the time is not yet. Permit me to add, however, that if I were in the position of The Imperial Oil Company I would certainly give Alberta, and particularly the Belly River Anticlinal Region, very close attention during the next two years, and in such manner that I would be fully prepared to act immediately and intelligently along practical lines to take advantage of everything favorable. Surely one in such position could well afford to do this, considering the large amount of money being expended by other people, as shown herein, and such a course of action would be along the lines of "Safety First" and at no great expense.
SECTION VIII. LANDS THAT MAY BE LEASED, &c.

In the consideration of the subject of oil and gas in Canada, especially in Alberta, we gave some attention to lands that may be leased, methods of obtaining a lease or concession, terms of the lease and titles, for, with this in mind and of record, you will have a better idea of conditions to apply to prospecting, past and future.

FIRST: The minerals in and under the major portion of all lands in the Provinces of Alberta and Saskatchewan have been reserved by the British Crown. Exceptions to this are:

SECOND: Lands conveyed in fee to the Canadian Pacific Railway.

THIRD: Lands conveyed in fee to the Calgary & Edmonton Railway.

FOURTH: Lands to which the fee simple title was reserved by the Hudson's Bay Company.

FIFTH: School Lands.

SIXTH: A small amount of land to which fee simple title has been obtained by present owners by purchase from the Canadian Government, the Railway Companies mentioned and the Hudsons Bay Company.

(1) As mentioned above, the title to the minerals in the major portion of the lands is still vested in the Crown, from whom the oil and gas prospector leases by filing on same in accordance with Rules and Regulations. (See Pamphlet, pages 60 to __, inclusive; also lease form, pages 72 to 77, inclusive). Only 1920 acres may be obtained from the Crown by filing by any one person or firm, but the Regulations mentioned will show that additional land may be secured by purchase from those who have filed on it.

According to Regulations, lessee must pay twenty-five (25) cents per acre for all the oil for the first year and fifty (50) cents per acre per annum thereafter. In addition to these
payments, lessee must begin operations within one year on each 1920 acres and prosecute same with diligence. If gas is found, the Crown reserves a royalty, to be prescribed from time to time by order of the Governor General of Canada. During 1914 a large area, extending within the Arctic Circle, in the vicinity of Fort McMurray and south to the International Boundary, was filed on and leases obtained by many different individuals and companies. This is not to infer that the territory is all under lease, but a lot of it was taken up and is still held through the leniency of the Crown, who, November 12, 1914, extended the time for the payment of the second rental to October 15th, 1915, and the time for the installation of machinery to November 12, 1915. It is now anticipated that a further extension will be granted on account of the war, but, if not, then only a very small portion of the large area of land mentioned will remain under lease.

(2) A prospector may obtain land to operate for oil and gas from the C. P. Railway, but terms and conditions of leases are prohibitive. (See C. P. R. Rules and Regulations for leasing land, pages 78 to 79, inclusive). We did not run across any C. P. R. land that was under lease, excepting a few pieces near Bow Island on which gas wells had been drilled.

(3) We did not make inquiry about C. & E. Railway lands, but presume them to be similar to C. P. R. lands.

(4) If the information obtained is correct, then the Hudson's Bay Company retain fee title to all of Sections 8 and three-quarters (3/4ths) of Sections 26 in each township, excepting where the township number is divisible by five (5), in which case the reservation includes all of both Sections 8 and 26. Whether or not oil and gas leases may be obtained on such lands we did not ascertain.

(5) We were informed that Sections 11 and 29 in each township in Alberta were School Lands and that each person obtaining a grant of 1920 acres of Crown land may then file on and ob-
tain 640 acres of School Lands from the Dominion Government, but under what terms and conditions we did not ascertain.

(6) There did not seem to be much fee land owned by individuals, although we heard of some. Just how title was procured was not ascertained, but to obtain an oil and gas lease on any of it it would be necessary to make the best bargain possible with the owner.

SECTION IX. QUESTION OF TITLE.

The only question of title called to our attention was that about reservation of minerals (supposed to include oil and gas) in Crown lands that had been patented or sold. In each instance the reservation is "all mines of coal and other minerals" and whether this would include oil or gas is the question. We understood the case was in the Courts (See pages 80 to 89, inclusive). In Pennsylvania such a reservation would not include oil and gas, but in West Virginia it would. It is a question of considerable importance to oil and gas operators and prospectors in Canada.

SECTION X. MISCELLANEOUS ITEMS.

The approximate contract prices paid in the different districts for drilling, the Contractor to furnish all labor, fuel, water, machinery and tools, and the Prospector rig and casing only, is given as follows, together with depth to which he would be required to drill and average time it takes:

<table>
<thead>
<tr>
<th>District</th>
<th>Rate per Foot.</th>
<th>Depth</th>
<th>Time it takes.</th>
</tr>
</thead>
<tbody>
<tr>
<td>Fort-hills Region</td>
<td>$10.00 to $15.00</td>
<td>5,000</td>
<td>12 months.</td>
</tr>
<tr>
<td>Medicine Hat</td>
<td>5.00 to 7.00</td>
<td>1,000</td>
<td>2 months.</td>
</tr>
<tr>
<td>Bow Island</td>
<td>7.00</td>
<td>2,000</td>
<td>3 to 4 months.</td>
</tr>
<tr>
<td>Sweet Grass</td>
<td>10.00</td>
<td>3,000</td>
<td>(?)</td>
</tr>
</tbody>
</table>

Please understand no regular provision or rate prevails, also that
a contractor may have to drill several holes to reach the required depth and, therefore, the time would be very indefinite.

The cost of building a drilling rig, with Calf Wheels, to drill 3,000 feet would approximate $2,000.00. The approximate cost of Casing, equipped with California Couplings and Baker Shoes, f.o.b. cars Southern Alberta railroad points, would be

<table>
<thead>
<tr>
<th>Size</th>
<th>Type</th>
<th>Per Foot Cost</th>
</tr>
</thead>
<tbody>
<tr>
<td>16&quot;</td>
<td>8 thread Drive Pipe</td>
<td>$5.00</td>
</tr>
<tr>
<td>13&quot;</td>
<td>8 thread Casing</td>
<td>3.55</td>
</tr>
<tr>
<td>10&quot;</td>
<td>8 thread Casing</td>
<td>2.10</td>
</tr>
<tr>
<td>8&quot;</td>
<td>8 thread Casing</td>
<td>1.25</td>
</tr>
<tr>
<td>6&quot;</td>
<td>8 thread Casing</td>
<td>1.00</td>
</tr>
</tbody>
</table>

Drillers receive $150.00 per month and up, and all expenses; Tool Dressers, $100.00 per month and all expenses; Firemen, $60.00 per month and all expenses. They generally have three men on tour, instead of two as in the States. Common labor costs 30 to 40 cents per hour. Teaming costs $5.00 to $7.00 per day. Timber and lumber costs $35.00 to $40.00 per M., f.o.b. railway delivery points. Several kinds of rigs and outfits have been used for the drilling, such as Canadian, Rotary and Cable, but the latter is the only one to prove a success so far.

The use of the term "wet gas" is often misleading, as the wetness is often water and not gasoline, as one might surmise from the use of the term.

We are indebted to Messrs. F. W. Gordon and J. A. Boyd, your Agents at Calgary and Edmonton, respectively, for kind and courteous treatment while we were with them; also to Mr. W. H. Bickel, of Calgary, who, having drilled all through the Province during the past three years, was in position to supply a lot of information.
Please accept our thanks for a very pleasant trip, and permit me to remain,

Yours very truly,

Copy- Mr. A. C. Bedford.

2.

P.S. Further within the Pocket, please find:
C. F. R. Schedule, which may be of use in connection with distances, altitudes and population of cities and towns.
Prospectus of Alberta Crude Oil Company, which will show how they get the money at Calgary.

Yours, &c.,

[Signature]
Review of

GEOLGY OF SOUTHERN ALBERTA AND SASKATCHEWAN, CANADA,

with Special Reference To

STRUCTURE AND OCCURRENCES OF OIL AND GAS.

CONTENTS,

Preface,

Report after investigation of publications, and field work in southern Alberta and Saskatchewan limited to one month. Preliminary statement of "Anticlinal Theory" and graphic description.

Limits of Territory Under Investigation,

The great planes of western Canada with sedimentary rocks undisturbed is limited on the east by the igneous formations of eastern Manitoba and north-eastern Saskatchewan; on the west by the Rocky Mountains; on the south by the United States; and on the north by the Arctic Ocean.

Rocky Mountain Foot Hills,

Rocks are faulted and over-folded. Long, but peaked anticline developed within two miles of east limit of foot hills, with crushed strata at apex. Faulting and over-folding still continues toward east before strata begins to level toward plains. Structure is unfavorable for occurrences of oil or gas in commercial quantities.

Tree-less Plains,

East from Foot hills there is shallow syncline, then low, flat anticline of immense lateral dimensions with frequent local structural relief favorable for pools of oil and gas. Gas in commercial quantities already found at Pellican Falls, Medicine Hat, Bow Island and Sweet Grass, and Viking. East from this anticline the formations dip gradually eastward to flat syncline in central Saskatchewan, then they slowly rise to igneous rocks of eastern Manitoba.

Muskeg Plateau,

Strata is nearly flat but slopes gently toward south where Athabaska "Tar Sands" dip under other Cretaceous rocks. In few localities there are local folds. Along shores of Great Slave Lake and on banks of Mackenzie River there are antedotes and many oil seeps from porous sands overlying petriferous limestones and shales of Devonian age.

Transportation Facilities,

Rivers open only during four months of year. Rail roads are now approaching navigable rivers tributary to Mackenzie River.
Review of Geology,
Alberta and Southern Saskatchewan Provinces, Canada.

Preface,
After an investigation of available publications, and field study limited to one month during parts of May and June, 1915, the following is submitted as a review of the Geology of Alberta and southern Saskatchewan provinces of Canada, with special reference to structure and its relation to accumulations of oil and gas. For the reader who is not familiar with the production of these substances, some preliminary remarks are made with graphical descriptions touching upon the commonly accepted theory of the accumulation of oil and gas in anticlines.

Anticlinal Theory,

In searching for an explanation of the occurrence of oil and gas in anticlines structural geologists have evolved the anticlinal theory.

Water is a very common substance, seeping and trickling through the rocks that compose the earth's crust, and oil or gas, when associated with water, tend to float or migrate upwards contrary to the usual operation of the force of gravity. If a cup full of oil, not in association with any other fluid, is left undisturbed, as at "X" in the sketch below, it will remain in the cup until it evaporates. If it is submerged in water in an upright position, as at "Y", the oil promptly floats out of the cup and to the top of the water; but if it is submerged in an inverted position, as at "Z", obviously the oil is sealed in and protected from the influence of evaporation by the underlying body of water, and it will so remain, while undisturbed, through ages of time.

\[\begin{align*}
X & \quad \text{Teacup filled with oil and not associated with water.} \\
Y & \quad \text{Immersed in water in upright position, oil floats out.} \\
Z & \quad \text{Immersed in inverted position, oil remains in cup.}
\end{align*}\]

**Theorem** - To confine oil in presence of water, containing vessel must be above.
An Anticline is a structural ridge, or the high part of a wrinkle or fold in the stratified rocks of the earth's crust, as at "A" in the sketch below. The structural depression or low part of the wrinkle in the strata, as at "S", is a Sincline. "M", where the strata slope uniformly in one direction, with no fold, is a Monocline.

Oil is thought to originate in shale or lime stone by chemical change or distillation, perhaps a few drops at a time as at "B". As water seeps or seaks down through the shale it finds the isolated globules of oil which are floated upward along paths, "C", into porous beds of sand rock or dolomite, "D", and until, in their upward migration, they come to an impervious stratum, "E", through which they cannot pass; still as long as there is a sloping under surface to the close grained impervious stratum which overlies the porous sand, the particles continue their upward migration along such surface, but whenever they have arrived at a point from which the roof of the porous body of sand slopes downward in all directions they are trapped, and there they remain and are joined by millions of globules of similarly migrating oil and gas through eons of geologic time.

The normal requisites for an accumulation are:
1st. A body of porous rock under which there are strata of shales or lime stones.
2nd. A close grained impervious cap or roof through which gas or oil cannot leak upward from the porous formation.
3rd. The cap of the porous sand must have an arched, or concave under surface, corresponding to the inverted cup shown above, in order that the oil or gas, always tending to float upward, shall be duly trapped and retained.