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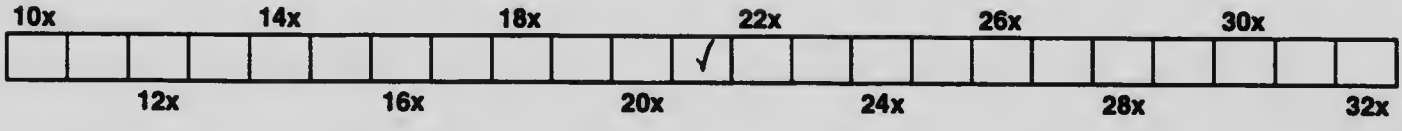

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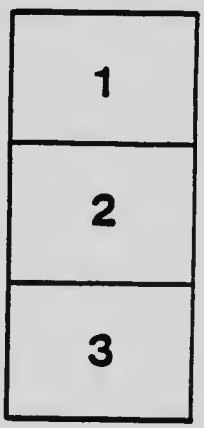

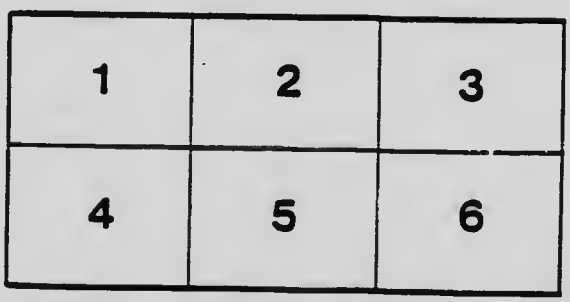

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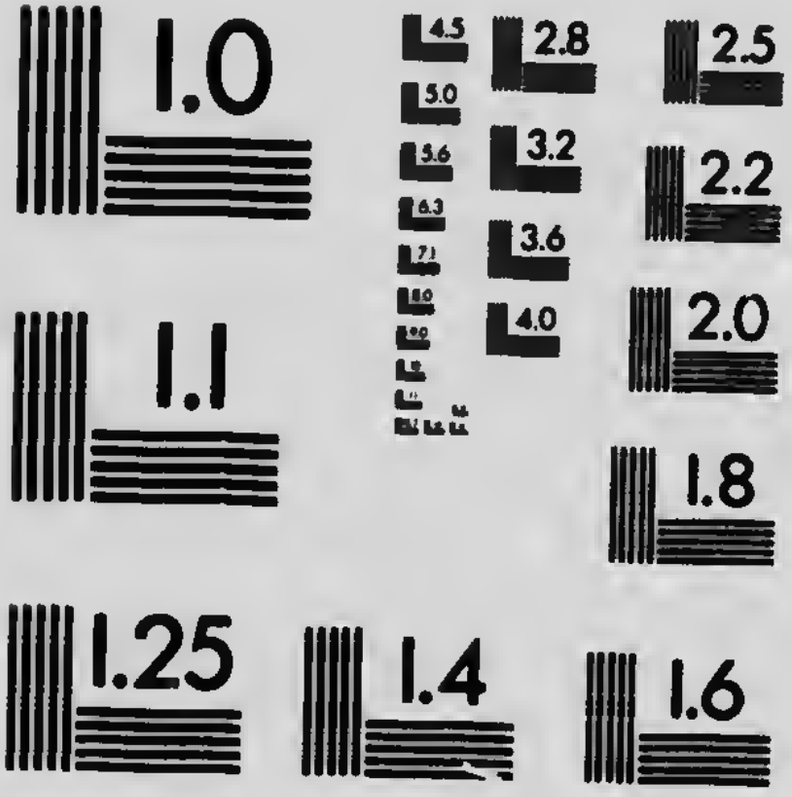

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REPORT

UPON

The Petroliferous Region,

SITUATED ON THE

NORTH-WEST COAST OF NEWFOUNDLAND,

BY

JAMES P HOWLEY, F.G.S.,

1909.

CHRONICLE JOB PRINT
St. John's, Nfld.

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REPORT ON THE PETROLEUM FIELD, WEST NEWFOUNDLAND.

GEOLOGICAL SURVEY OFFICE,
ST. JOHN'S, N.F.,
JUNE 8TH, 1909.

HON. SIR E. P. MORRIS, K.C., LL.D., KT.,
PRIME MINISTER:

SIR,—

In compliance with your request, I beg to furnish you with the following report upon the Petroliferous district of the West Coast.

Facing the Gulf of St. Lawrence, on the western side of this Island, the coast line from the vicinity of Bonne Bay almost to its northern extremity, Cape Norman, is occupied by a low and comparatively level strip of land, particularly so from about St. Paul's Inlet to Hawke's Bay. About midway between the two latter points, at a place called Shallow Bay, some thirty miles north of Bonne Bay, a large salt-water lagoon, known as Parsons' Pond, occurs. It stretches inland at right angles to the coast eight miles, to the base of the Long Range Mountains, and has a superficial area of about nine square miles. The shores are low and flat, and at some parts fairly well wooded towards the foot-hills of the mountain range. It is on the claims of the Newfoundland Oil Developing Company are situated: they surround the pond on either side in a strip of about a mile wide, and comprise a total area of some twelve square miles.

During recent years, drilling operations to develop the possibilities of this region for oil have been conducted by the above company, the results of which, to date, will appear further on.

GEOLOGICAL STRUCTURE.

Geologically, the rock formation of this strip of country consists of a series of sandstones, shales, and thin-bedded limestones, arranged in a succession of sharp, narrow folds, repeating the same strata several times, with what is termed an overturn dip. This gives them the appearance of being all inclined in the same direction, towards the Mountains. The base of the series, which at Cow Head consists of heavy-bedded, nodular grey limestone, is again seen rising to the surface at the foot of the mountain range, where the strata assume an almost vertical attitude. The entire low-lying tract between the coast and the mountains is underlaid by the softer and less durable sandstones and shale, etc. The whole series appears to be referable to what is known in Canadian geology as the Quebec Group, particularly to the Levis and Sillery divisions thereof, with perhaps some higher members of the Lower Silurian Series. The more shaley portions of the formation are characterized by numerous fossil organisms, chiefly those fine pencil-like markings known as graptolites—a species of zoophyte, or animal plants. A few small lingula also occur, more particularly in the thin limestone bands. Those organisms either grew on the muddy bottom of a shallow sea or floated about loose in the waters, during the period of deposition. The graptolites are so abundant in some of the shales as to constitute a considerable portion of their bulk, and cause them to assume a dark brown carbonaceous appearance. I have been thus particular in describing those fossils, because, I have reason to believe, they were the chief source from whence the petroleum was derived.

The origin of the Hydrocarbons, of which petroleum is perhaps the most important, has been the cause of a great diversity of opinion amongst scientists. Some contend that they were purely of mineral origin; others that they were devived from vegetable or animal substances, or of both combined. The majority incline to the latter opinion, and certainly my own observation in this region seems to point to the same conclusion. At all events, the fact of the petroleum occurring in those rocks so filled with animal-plant remains, such as would appear likely

to yield, under decomposition and great pressure, this hydrocarbonaceous substance, is very significant. Whether this conclusion be the correct one or not, it is very noticeable that the darker colored shales containing most fossils, were found to be most bituminous. The thin limestone bands were not destitute of the substance either, but were frequently so impregnated with petroleum as to give off a strong odour when freshly broken, and small drusy cavaties occur here and there in these same rocks, filled with crude petroleum of about the consistency of treacle. The sandstones seemed also apparently destitute of fossils, and showed little indication of a petroliferous character. Judging from the foregoing, I am led to the conclusion that the shales and limestones are the chief repositories of the substance and it is from those strata, or set of strata, which exhibit the most highly bituminous character, the best results may be expected.

Hitherto, though oil has been known to occur at many different geological horizons, no productive wells, that I know of, have been located in any formation lower down than the Trenton Limestone, of the Lower Silurian Series. The latter is that from which the large outpnt of oil in the State of Ohio is derived. The other productive fields of North America are the Petrolea and Oil Springs, Enniskillen County, Ontario, situated in the Corniferous Limestone, Devonian Series, of more recent date. The Pennsylvania and New York deposits are derived, partly, from the Devonian and sub-carboniferous series, while in Colorado the oil producer is Cretaceous, and in California of Tertiary age, both being much more recent in point of geological time. Again, in southern Russia, the oil region is situated in formations of comparatively recent deposition.

It might be inferred from the above facts that our Newfoundland deposits were at too low an horizon to expect oil in any quantity, but, says the author of the "Mineral Resources of the United States," "There have been so many surprises in petroleum that any statements made must be regarded as only setting forth the indications as to producing localities at the present time." By this it is plain he does not pretend to say that the present known localities or geological series of formations are

the only ones likely to be productive, and that he would be prepared at any time to learn of entirely new and hitherto untried rock formations yielding oil. Being desirous of having further expert opinion on this head, I wrote the late Dr. G. M. Dawson, C.M.G., head of the Geological Survey of Canada, asking what he thought of the prospects for petroleum in available quantity so low down as the Levis Shales. His reply was: "I may say "that I cannot see anything against such occurrence, provided "the rocks themselves are not so much altered as to render it "improbable. This would appear to be the case, as petroleum "actually exists in them, and the question of quantity would "become, I suppose, rather a matter of structure and com-"position of the rock series than anything else." In another letter he says: "Assuming that the Levis shales are about "equivalent to the Calciferous formation, and knowing that oil "occurs abundantly in some parts of the Trenton formation, "there can really be nothing against its occurrence at a couple "of stages lower in the same conformable series, if the physical "conditions are suitable." These statements coming from so high an authority have removed, to a considerable extent, any doubts I may have entertained as to the possible productiveness of this petroliferous region.

With regard to the structure and composition of the series and other physical conditions found to exist here, I find that, though so very far removed, both geographically and geologically, from the California oil region, they bear a very striking resemblance to each other, and, above all, the condition in which the rocks occur, viz., folded into sharp troughs with high angles of inclination, is identical.

HISTORY OF THE DEVELOPMENT OF PARSONS' POND OIL FIELD.

The history of the attempts to develop this petroleum region is briefly as follows:

Many years ago a person named Silver had his attention drawn to an oily substance floating on the surface of the water, which seemed to issue from the mud at the bottom of the lake,

and which proved, on examination, to be petroleum. Mr. Silver, who was a mill owner, and a man of some means, procured a drilling outfit and had a hole put down near the lake shore, some six miles from its outlet. What the result of this boring was I have never been able to ascertain, but it is certain some oil was struck. The drilling tools were of the most antiquated character, and no doubt very badly handled as well.

About the year 1893 the Newfoundland Oil Company was formed, who secured a lease of a large area of the territory surrounding the lake. They commenced drilling near the site of the old hole, and though oil was obtained, the whole business was so badly conducted, and, as a concequence, so much money wasted, the company were thereby greatly discouraged in their further prosecution of the work. The following year they procured the services of a Mr. Spotiswood, a man of well-established reputation, to visit the place and make an inspection of the property. Mr. Spotiswood's report was of a very favorable character, but he condemned in strong terms the crude methods and out-of-date appliances hitherto used, and gave instructions how the work should be carried on. He was then employed by the company to conduct the further operations himself. He took charge in 1896, and soon made things look more promising. In cleaning out the hole already put down, preparatory to commencing work, he found everything in a very bad state. The piping was broken and telescoped, the drill rods parted, and tools left down in the hole. It took him a great part of the season to withdraw the broken pipes, fish up the tools, and get everything in proper working order. Most unfortunately for the company, poor Spotiswood, who was a delicate man, took sick and had to give up work before the season closed. He entered the hospital in St. John's, where he soon died, without handing in his report.

While the writer was engaged in making a trigonometrical survey of the lake and surrounding country, and a close investigation of its geological features, frequent visits were paid to Mr. Spotiswood and the scene of his operations. We then compared notes and interchanged views as to the various matters which

came under our observations. The drilling and its results being Mr. Spotiswood's especial business, I of course did not pay particular attention to it. A sort of professional etiquette, well understood amongst scientists, hindered me from making such minute enquiries into his operations as I otherwise would have done had I anticipated his untimely end. His demise was a great set back to the company, and as there was no one else cognizant of the exact nature of the work performed, I was asked to furnish such particulars as I had gathered from him during my sojourn on the ground, coupled with my own observations. This was given in the form of a short report, which the company published. Since then I have constantly watched with much interest the progress of the development work, and offered suggestions, as requested, from time to time.

The hole put down by Mr. Spotiswood was yielding, at the time I was there, according to his statement, a paying quantity of oil. He pronounced it to be of excellent quality, being a sweet oil, very free from deleterious substances. Before he left the place he commenced another hole nearer the lake shore, but was unable to complete it.

The company now set to work more vigorously to develop their property, and during the subsequent years, up to 1906, several new holes were drilled, all of which showed more or less oil. I understand nine wells have been drilled altogether,—exclusive of that put down by Mr. Silver,—four on one side and five on the other side of the lake. A good deal of mismanagement and want of experience has characterized this work throughout, and some of the best yielding wells have been ruined by neglect or otherwise. They were allowed to lie idle and fill with water for several years. As a consequence, some of them ceased to yield oil, being, to use an oilman's term, "drowned out."

No regular attempt to pump these wells was made till 1904, when proper machinery was installed for that purpose, and a fair test given them. It appears from the superintendent's report of that year that four of the wells on the western side of the pond, after a two months' trial, yielded steadily an aggregate of

six (6) barrels daily, while No. 1 well, on the eastern side, during a five months' test, gave a daily average of 4½ barrels. Over seven hundred (700) barrels were pumped in all, some three hundred (300) of which were used as fuel, with good results.

An attempt had been made the year previous to "shoot" one of the wells on the west side with dynamite, but the charge failed to ignite, and remained at the bottom, leaving the hole in too dangerous a condition to be operated; nevertheless, it remained full of oil.

All the petroleum obtained was of superior quality, that from No 1 well, east side, in particular, being a rich, heavy lubricating oil of a light amber colour, and containing much paraffin, wax, etc. The drillman pronounced this the richest oil he had ever seen. He used it on his engines, and found it so satisfactory, even in its crude state, that he discarded the use of his other machine oil thereafter. This well also produced a steady yield of gas, all but sufficient to keep the machinery running.

In 1905 No. 2 well, eastern side, was continued down to a depth of 1,090 feet, No. 3 to 70 feet, as a water well only, and No. 4 to a depth of 1,535 feet. This last well began with a natural yield of about six barrels per diem. Four of the wells were now exploded, two on the east side and two on the west side of the pond, with results of a curious, and not altogether satisfactory nature. No. 3, west side, which was giving only ¾ of a barrel before exploding, increased to 1½ barrels, and later to 6½ barrels. No. 4, same side, which gave 2 barrels the previous year, but had run dry, showed no improvement, and still ceased to produce anything. No. 1, east side, which had yielded 4½ barrels, of such superior character, had become choked by the conversion of its rich heavy oil into wax. This also failed to produce after explosion, while No. 3, east side, yielding 6 barrels before, dropped to 1, and then slowly increased to 1½ barrels. It was now allowed to rest for a few months, when it was again put to pumping, and was found to have improved considerably, giving from 2½ to 3 barrels daily.

The rather discouraging results of this experiment threw a damper upon the company's operations, and since that date little more has been done than to keep the yielding wells to pumping. No new wells have been drilled the last couple of years, and at present a caretaker only is employed to look after the plant.

Much of the oil stored in tanks had been lost, owing to carelessness in construction or otherwise. Some of the tanks became frozen up, and were burst apart, allowing the oil to escape. During the past two years some 800 or 900 barrels of this petroleum were shipped to the Gas Works in this city, to be used in conjunction with coal for enriching the gas supply, and the result has proven very satisfactory. The company has lately been remodeled and its name changed to that of The Newfoundland Oil Developing Company, Limited.

In view of the unfavorable results of the exploding test, it becomes a question as to whether it be advisable to resort to this expedient at all. There may be exceptional cases where the experiment might produce favorable effects, but the strong probability of its proving otherwise should, I imagine, call for the exercise of much caution before resorting to this method. A thorough knowledge of the geological structure, and of the mode of occurrence of the petroleum, appear to me of essential importance in this connection. Perhaps the safest rule to adopt would be not to explode any well which was yielding a remunerative quantity of oil, even though a small one. I look upon a slow, evenly maintained, seepage from the petroliferous strata as indicative of more permanency than a sudden gush of oil at first. Any well yielding five or six barrels per day should certainly not be tampered with so long as it produced anything like that amount. On the other hand, wells which showed little or no oil, or such as may have run dry, might be brought to produce by exploding them.

Those that have ceased to yield after being so treated should not, in my opinion, be utterly abandoned. It is quite possible that by sinking to a greater depth other and lower petroliferous strata may be tapped, and oil again come in. The experiment would be at least worth trying.

From all that has been ascertained it is clear that the experimental work, more particularly in the earlier stages, has been conducted in a very unskilful manner, and that the apparatus used was, for the most part, out-of-date. Yet this is but the history of most of the initial attempts at mining development.

The foregoing applies more particularly to that portion of the region surrounding Parsons' Pond, a small section only of which has as yet been tested by the drill rod. Similar geological conditions are known to be applicable to a large extent of the territory on either side of the pond, and oil may reasonably be expected to occur at many other parts of their distribution. For that matter, indications of petroleum are met with along the whole extent of coast, from the vicinity of Port au Port Bay, for a distance of at least 200 miles northward. Towards the western extremity the strata are so much disturbed and altered by igneous and metamorphic action as to afford little prospect of oil in available quantity occurring. Portions of the petroliferous strata are seen at many points, caught up in, or twisted and contorted by the intrusion of trap dykes, etc., yet in every case these sections indicate the presence of petroleum, some of the rocks being saturated with it.

From this it may be inferred that it is the more northerly portion of the coast which affords the greatest promise. The operations in the immediate vicinity of Parsons' Pond have clearly demonstrated the existence of oil in no inconsiderable quantity at that point. Sufficient work has been accomplished there to prove beyond question that the territory is a petroliferous one. No well, so far, sunk has proved entirely destitute of some show of oil, which cannot be said of every oil field. It appears to me only a question of putting down a sufficient number of wells to make it a paying proposition. If the yeild during 1904–5 be taken as a criterion to form a basis for calculation, the wells then operated gave a total of 10½ barrels per diem, or an average of over 2 barrels per well, and it is but reasonable to suppose that other wells yet to be sunk will afford at least as good results. Were the property adequately and efficiently developed so as to reach a point where it would yield say 250 bar-

rels daily, this I consider amply sufficient to warrant the erection of a refinery upon the ground, for the treatment of the product before shipping. Its value would be thereby greatly enhanced, as it is well known that most of the profits in oil are derived from the by-products, all of which are lost to the producers when the material is marketed in its raw state.

If the mismanagement and crude methods hitherto so apparent were remedied, and more up-to-date apparatus used in the drilling, I see no reason why, eventually, a prosperous oil industry should not develop in this promising region.

I append a few of the analyses made from time to time which will afford some idea of the character of the product.

Analysis Made at the Chemical Laboratory, Acadia Mines, by William Small, E. A. Sec., September 1st, 1902.

Specific gravity	150 deg. C. -O. 879
Water and Light Oils	2.44 per cent.
Normal Oils	54.00 " "
Lubricating Oils Tailings, etc.	43.66 " "

Analysis Made for Mr. Spotiswood, by J. T. Donald, Montreal, Septmber, 1894.

Specific gravity	885 or 28 deg. B.
Water	Traces
Gasolene	None
Naptha	None
Burning Oil	14.50 per cent.
Heavy or Lubricating Oil	82.50 " "
Solid Residuum	3.00 " "
Sulphur	.098 " "

Analysis Made by Boverton Redwood, London, England, February, 1897.

Crude petroleum from Newfoundland—colour: Dark Brown by transmitted light, moderate fluorescence, imparting a characteristic Green colour by reflected light. Odour not unpleasant.

Specific gravity at 60 deg. F	O. 842
Flashing point, close test	128 deg. F
Cold Test, ceases to flow at	15 deg. F

Results obtained on fractional distillation (each fraction 1-10th by volume of the crude oil):—

No. of Fraction	Temperature of Distillation	Sp.Gr. at 60 deg. F.
1	365 deg. to 468 deg. F.	.770
2	468 deg. " 518 deg. "	.785
3	518 deg. " 572 deg. "	.800
4	572 deg. " 630 deg. "	.814
5	630 deg. " 690 deg. "	.825
6	690 deg. " 766 deg. "	.839
7	766 deg. " 817 deg. "	.852

Fraction six (6) solidified when cooled to 32 deg. F., owing to the crystalization of solid hydrocarbons, and the succeeding fractions were soild at ordinary temperatures from the same cause.

Percentage of commercial products by weight:—

Benzine	Nil
Kerosene—Sp. Gr...799..Flashing point (close test)	47.6
Intermediate and heavy lubricating oils with solid hydrocarbons (paraffin)	50.4
Coke	2.0
	100.0

These results conclusively show that the sample may be properly described as a crude petroleum of excellent quality. The yield of Kerosene is sufficiently high, and might readily be increased if desired, by "cracking." In addition, lubricating oils of various grades, and a fair proportion of solid hydrocarbons (paraffin) might be obtained, or if "cracking" were resorted to with the object of increasing the yield of Kerosene, the residue might be employed as a source of gas oil and fuel oil.

(Signed) BOVERTON REDWOOD.

Analysis Made by Irving A. Bachman, Ph. D., Analytical and Consulting Chemist, Allentown, P.A. (from sample of one barrel).

Colour—brown black, with green cast.

Odour—when agitated it is that of naptha mixed with sulphur compounds.

Specific gravity—0.833 at 15 deg. C. On long standing the heaviest oil settles to the bottom in a viscid oil of a brown colour.

CHEMICAL ANALYSIS.

Carbon	84.13 per cent.
Sulphur	1.01 " "
Bromine absorption	9.89 " "
Hydrogen	13.33 " "
Ash	0.07 " "

Distillation at Atmospheric Pressure.

110 deg. to 150 deg. C. afforded 9.95 per cent. oil of .7272 Sp. Gr.

150 deg. to 220 deg. C. afforded 16.81 per cent. oil of .7649 Sp. Gr.

220 deg. to 257 deg. C. afforded 11.05 per cent. oil of .7890 Sp. Gr.

257 deg. to 300 deg. C. afforded 9.09 per cent. oil of .8088 Sp. Gr.

300 deg. to 350 deg. C. afforded 8.51 per cent. oil of .8200 Sp. Gr.

Total	55.41
Residue	43.00

Distillate at

110 deg. to 150 deg. C. afforded oil of .7272 Sp. Gr. yielded .08 per cent. Sulphur.

150 deg. to 220 deg. C. afforded oil of .7649 Sp. Gr. yielded .13 per cent. Sulphur.

220 deg. to 257 deg. C. afforded oil of .7890 Sp. Gr. yielded .22 per cent. Sulphur.

257 deg. to 300 deg. C. afforded oil of .8088 Sp. Gr. yielded .26 per cent. Sulphur.

300 deg. to 350 deg. C. afforded oil of .8200 Sp Gr. yielded .29 per cent. Sulphur.

The oil of .7272 Sp. Gravity afforded Bromine absorption of .51 per cent.

The oil of .7649 Sp. Gravity afforded Bromine absorption of 1.11 per cent.

The oil of .7890 Sp. Gravity afforded Bromine absorption of 3.29 per cent.

The oil of .8088 Sp. Gravity afforded Bromine absorption of 4.81 per cent.

The oil of .8200 Sp. Gravity afforded Bromine absorption of 9.09 per cent.

The distillation below 220 deg. C. was clear and colourless, but above that temperature, became tinged with yellow.

The analysis resolves itself into the following per centages of commercial products:—

Gasolene, naphtha and benzine	10.00	per cent.
Kerosene	36.00	" "
Lubricating oils	40.00	" "

The lubricating oils are of high density, very rich in the higher paraffin compounds, and will give an oil of good body and fine texture.

The examination proves the oil to be somewhat different from the average Canadian petroleum in that it is a lighter oil, yielding more light oil. The oil is analogous to the Ohio oil, being heavier than the Pennsylvania oil, and lighter than the Canadian oils.

(Signed) IRVING A. BACHMAN.

I have the honour to be,

Sir,

Your obedient servant,

JAMES P. HOWLEY.