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Correspondence and unpublished report re: Possibility of oil in Michigan and Wisconsin. 1922-1929

Thwaites, F. T. (Fredrik Turville), 1883-1961

[s.l.]: [s.n.], 1922-1929

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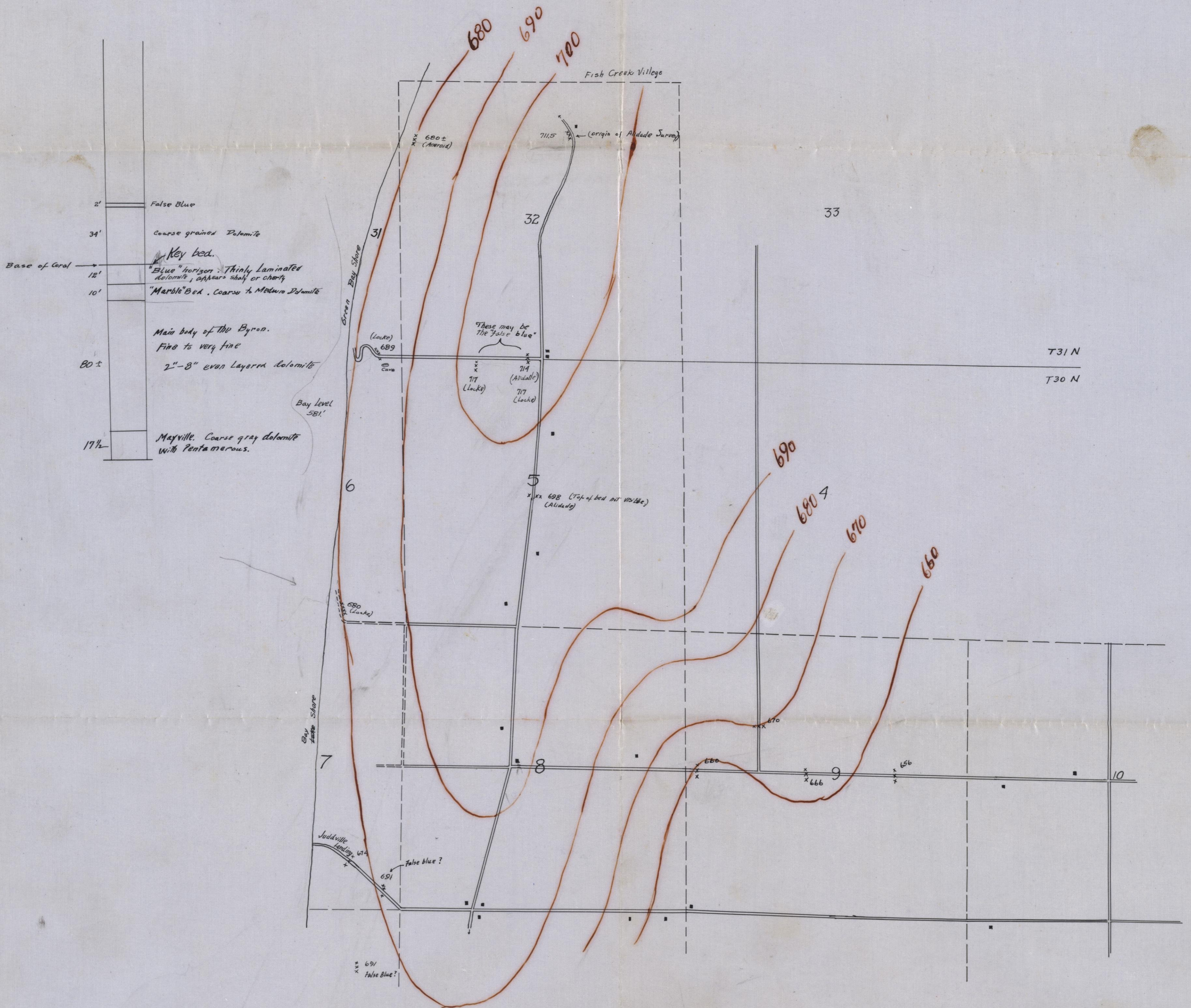
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R21E



SCALE 1" = 1250'

Copy of Plane-Table survey made by F.T. Thwaites and R.C. Lentz
Door County, Wisconsin. 1922.

Jan 4, 1929

Paper on oil in Wisconsin by Ralph Arnold

Historical. Exploration for oil and gas has gone on in Wisconsin right down to the present although not very many wells have been drilled. Important exploration holes were put down by (1) Tornado Oil and Gas Co., near Brussels, (2) unknown parties south of Kaukauna (a hole down to granite), (3) J. J. Faust and sons for some local people at Hollandtown, (4) a company at Cambria, (5) some parties at Pewaukee, (6) a farmer near Sheboygan Falls. This does not include the surface explorations done by the writer in Door County nor anything done by companies which did not reach the actual drilling stage.

Geology. The review of geology does not make it clear that the center and basement of the state are composed of old hard rocks. The only part of the state in which the pre-Cambrian basement has not been reached is along the Lake Michigan shore south from Two Rivers. The maximum thickness of sediments probably exceeds 3000 feet near Milwaukee but is less in all other parts of the state with the exception of the very thick Keewenawan sandstones and shales along Lake Superior.

Structure. The writer has mapped the structure of eastern Wisconsin in as great detail as the data permit. Large areas have not been drilled and are covered with glacial drift. Structures which are known are in large part ^{known} to be above hills on the pre-Cambrian surface. On account of drift cover little is known of structure along the Lake Michigan shore. The largest known anticline is at Two Rivers but is not known to have a closure.

Geologic section. The writer would not advise subdividing the Niagara in such a brief section. The Trenton of the old survey is now called Black RIVER. The Galena and Black River correspond roughly to the Trenton of adjacent states. The term Potsdam is no longer used in Wisconsin and if employed at all should be quoted. Although the waters of the St. Peter and other sandstones ^{are} mainly fresh there is somewhat salty water at Sheboygan and possibly elsewhere.

Structure. It is not correct to say that there is no oil in the St. Peter because of lack of structure. There is a marked anticline at Fond du Lac which has been flushed by fresh water, if it ever did contain oil. The thickness of the Trenton stated is incorrect if ~~the meaning is~~ the thickness of the possibly oil-bearing dolomites beneath the Richmond shale is meant. The figure should mean the Galena-Black River group as a whole. See paper on Paleozoic rocks found in deep wells. Shows of oil are found in nearly every well drilled in eastern Wisconsin; these occur (1) in the brown bituminous layers of the Richmond, and (2) in or near the top of the Galena where under heavy cover. Small shows have also been found in the Devonian near Milwaukee. The exploration at Brussels is claimed to have shown several gallons of oil.

Gas in drift. Gas has been found associated with a buried forest in the glacial drift of northeastern Wisconsin and to some extent in southeastern Wisconsin. Commercial development has been slight on account of water troubles and rapid failure of pressure. Character of the gas is not known but may be surmised

Depth of wells. It has been reported that ^{the late} F. M. Gray, Sr., once drilled a well west of Milwaukee to a depth of over 3000 feet. Modern wells rarely reach 1800 feet on account of high sulphate and chloride content of deeper waters.

Drilling methods. Most old wells were drilled either with pole tools or with standard cable tool rig. At present nearly all deep wells are being drilled with portable rigs.

Conclusions. Bituminous rocks are present in sufficient quantity to allow of oil accumulation particularly where the lower brown shale of the Richmond is in contact with the Galena dolomite. The main reasons for lack of oil ^{production} are (a) thorough flushing by fresh waters working down the dip, and (b) small closure of known structures. Pools which have not been flushed out may yet be found in the Two Rivers anticline or in structures whose existence is concealed by drift.

F. T. Thwaites

Geologist in charge of well records

October 21, 1922.

Mr. A. C. Veatch,
Sinclair Exploration Company,
Sinclair Oil Building,
45 Nassau,
New York City.

Dear Sir:

In reply to yours of the 16th:

(1) The field work was done by me with the assistance of Mr. R. C. Lentz and cost us about \$300.00. We wish, in case you take up the exploration after examination, to have this refunded to us and to be carried, without assessment, for a percentage, say 10 per cent, any additional field expenses also to be paid in case you go ahead.

(2) We know of no leases whatever in the territory north of Sturgeon Bay which we think most favorable. We thought it best to take no leases at present as this would arouse a host of undesirable speculators and fake promoters, some of whom are already operating in the state. All leased territory south of Sturgeon Bay examined by us is worthless, not having been located on structure.

(3) I do not know anything about the different possibilities of obtaining leases, but think that almost anything you desire could be arranged. The country on the east side of the peninsula is held by German and Norwegian farmers but on the west side there are many small tracts owned by outsiders who have summer cottages. Most of the west coast has been definitely condemned.

The facts on which we recommend exploration are as follows:

(1) The Black River (Trenton) dolomite is under sufficient cover to retain oil lying below the Maquoketa shale which is over 400 feet thick.

(2) We have so far found two definite closed anticlinal structures; they may be due, as are others to the west, to irregularities of the pre-Cambrian floor in which case they probably increase in size with depth. Other structures may exist which we were unable to demonstrate in the time available. South of Sturgeon Bay the drift is too thick for effective work on structure.

A.C.V...2.

(3) Bituminous residue is known on the outcrop in northern Michigan as described in Publication #4 of the Michigan Survey. Mr. Robinson of the Michigan Survey has expressed the belief that oil has migrated from that state toward the outcrop and that it may have lodged in favorable structures in the Door Peninsula. Mr. Smith, the State Geologist of Michigan, also seems to hold this view.

(4) Oil showings are reported from several deep wells near Sturgeon Bay. In the case of the two city wells the information seems reliable. I have seen oil near Kaukauna which I believe comes from the Trenton; other supposed seepages are, however, not of natural origin.

(5) Exploration would be cheap compared with other fields. I inclose blueprint log of one of the two wells at Sturgeon Bay in which some showing of oil is reported.

Should you send someone to look over the proposition, I will be glad to either go with him in the field or send Mr. Lentz, who is my partner in the enterprise.

Very truly yours,

FTT-M

June 18, 1929

Mr. Joseph Olson,
Rockford Trust Co.,
Rockford, Illinois

Dear Mr. Olson: I wish to thank you for your letter and check of June 15. Enclosed please find receipted statement.

With regard to Missaukee and Roscommon Counties in southern Michigan I regard this country as much more favorable than anything in the Northern Peninsula. The only trouble is that outcrops are scarce and it is therefore hard to work out structure. This is the only thing which kept Michigan from becoming an oil producing state long ago.

I think that Mr. Wayland Osgood of the Michigan Geological Survey, who is a friend of mine, would be able to give you up to the minute information on this region. My advice would be to make a thorough study of the locality in search of outcrops. If there are few or none I would advise putting down several test borings to some formation which can be recognized, like the Lower Marshall sand. Small holes can be drilled cheaply through the heavy drift cover if a combination rotary and diamond drill outfit is used. Otherwise it would be very expensive to even get down to bed rock. If such holes disclosed an anticline then a larger boring could be carried down to the lower formations to test them for oil. Deep holes are very expensive and a single failure which does not condemn the district will often use up all available funds. It would not be necessary to take leases if it is explained that the hole is simply to test structure. In Oklahoma I understand that they simply make a settlement for damage due to drilling the hole. Of course, it is absolutely necessary to preserve absolute secrecy even as to the true depth of the hole.

I have taken a position with the Illinois State Geological Survey for the summer and will start work with them on July 1.

Very truly yours,

F. T. T.

Rockford Trust Company

AFFILIATED WITH THE ROCKFORD NATIONAL BANK

COMBINED CAPITAL AND SURPLUS \$1,700,000.00

Rockford, Illinois.

June 15, 1929

Mr. F. T. Thwaites,
R. F. D. No. 4,
Madison, Wisconsin.

Dear Mr. Thwaites:

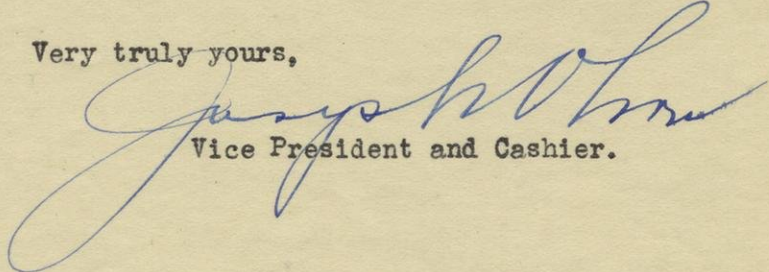
I am enclosing herewith my check for \$203.90 in payment of your statement rendered to me.

I am returning herewith your letter covering the amount of this bill and wish you would receipt and return it to me at your convenience.

I am negotiating now for a lease on a considerable tract of land in Missaukee and Roscommon Counties in Michigan. I would appreciate it very much if you could take it up with some one who can give you some information on it and advise me what they think of the oil possibilities in that vicinity.

Your prompt reply will be appreciated.

Very truly yours,


Vice President and Cashier.

JO'CC

R. D. 4, Madison, Wisconsin

June 8, 1929

Mr. Joseph Olson,
Rockford Trust Co.,
Rockford, Illinois

Dear Mr. Olson: Enclosed please find three copies of my report on the oil possibilities of the tract you have leased near Manistique, Michigan. I regret that it is no more favorable but I am convinced that the former exploration virtually settles the matter.

My charges are as follows:

Four (4) days time at \$50.00 per day	\$200.00
Photographs and cement	1.00
Van Dyke prints	.40
Typing	2.50
Total	<u>\$203.90</u>

I will be working in Illinois this summer so may possibly see you again. If there is anything I have not discussed to your satisfaction I will be pleased to explain it further.

fa

Very truly yours,

May 27, 1929

Mr. Joseph Olson,
Rockford Trust Co.,
Rockford, Illinois

Dear Mr. Olson: Confirming our telephone conversation of this morning I understand that I am to meet you Wednesday afternoon. On thinking the matter over I decided that as I have a class which lasts until 4:20 it would be best to bring my things over to Science Hall and then have you pick me up there. My office is Room 211 which is at the north end of the Second floor. It is not correct in the directory. Science Hall is the red brick building on Park St. opposite the Historical Library. You can go straight ahead where 15 turns west at the stop and go sign in Madison and Science Hall will be seen on the left at the end of the block on that side. I expect that we will be able to get back not later than Monday morning so will arrange for my Friday class only.

Very truly yours,

F. T. T.

F. T. Thwaites

Confidential

OIL POSSIBILITIES IN SHEBOYGAN COUNTY, WISCONSIN

F. T. Thwaites

General. The following report deals with observations made in the field on October 12 and 13, 1923, and with study of the area from data available in reports and in the files of the State Geological Survey at Madison. It is divided into two parts: (I) the possibility of the occurrence of commercial amounts of oil and gas in Sheboygan County, and (II) remarks on the validity of evidence derived from the so-called "instrument" or "wigglegstick."

Part I

Possibilities of commercial oil and gas in Sheboygan County

General geology. Sheboygan County is almost wholly covered by loose material or glacial drift. The drift is thickest in the western part of the county where it is locally more than 400 feet thick. There are only six places in the county where bed rock is known to show at the surface. Most information is, therefore, based on records of wells.

Geological formations. The bed rocks of Sheboygan County consist of a series of limestones, shales, and sandstones. These have been explored to a maximum depth of 1782 feet. The several different kinds of rocks are called "formations" and have received names from places where they were first studied.

The geological formations are from the top down: (a) Niagara dolomite-limestone, white colored, maximum thickness 719 feet, (b) Richmond or Cincinnati shale, blue colored, soft, with some hard layers of limestone, thickness from 240 to 265 feet, (c) Galena-Black River or Galena-Trenton dolomite-limestone, gray at top, blue and gray lower down, thickness from 187 1/2 to 330 feet, (d) St. Peter and other sandstones, soft, gray colored, penetrated to maximum of over 500 feet, total thickness probably at least 1,000 feet, and (e) granite and other hard rocks not reached by wells in this county.

Possible oil-bearing formations. The only formation in Sheboygan County which might carry oil or gas in commercial amounts is the Galena-Black River limestone. The Richmond shale which overlies it is known to contain some layers which give off an oily odor when heated, but the presence of such has not been demonstrated in this area. It was reported that a very slight show of oil was obtained from the Richmond shale while drilling the deep well at the Crystal Lake Crushed Stone Company gravel pit. The foreman at the pit stated that this did not amount to anything and disappeared as soon as the well was pumped. There is no record of any show of oil or gas whatever in the Galena-Black River of this county. The Niagara limestone contains no oil or gas as has been abundantly proved by the many wells which extend into it. The sandstones below the Galena-Black River are wholly filled with water, fresh in the western part of the county and somewhat salty in the eastern part where the formations are farther from the surface. The granite is known to contain no oil as it is an igneous rock.

Comparison with other areas. The Galena-Black River limestone extends from Wisconsin into Michigan, Illinois, Indiana, and Ohio as well as other states. In northwestern Ohio, northeastern Indiana, and southeastern Illinois commercial production of oil and gas has been obtained from the limestone which is there called the "Trenton." Nowhere else has anything more than a slight show been obtained.

Explanation of difference. Oil and natural gas are now positively known to have originated from the slow decay of organic matter which was buried in the rocks when they were deposited beneath the sea. Rocks which contain organic matter are black or brown in color. In Ohio and Indiana there is present a brown and black shale between the Richmond shale and the top of the Trenton; this is called the Utica shale. No such shale which would be a source for oil and gas is known in Sheboygan County. It seems decidedly questionable if there is enough organic matter in the rocks of Sheboygan County to have made any commercial deposits of oil and gas.

Conditions governing the accumulation of oil and gas. Where there is sufficient organic matter to decompose into oil and gas, deposits of commercial value occur only where these substances have accumulated into pockets or "pools." Two conditions are needed to have this happen: (a) porous layers or strata, either sandstone or much fractured limestone, and (b) impervious layers or strata so situated above the pervious rock as to prevent the escape of the oil and gas to the surface of the ground. Although the accumulation of oil is called an "oil pool", it must be realized that there is no large opening

but only a saturation of the cavities in the rock. (Note: Mr. Larson uses the word "strata" as meaning "pool." It really means layers of rock of any kind.) The second condition is most commonly brought about by an arch or upward bend of the formations, a feature known to geologists as a dome or "anticline." The lay of the rock formations is known as the "structure" of an area, but in the oil fields anticlines are often spoken of as "structures."

Structure in Sheboygan County. The several rock formations of Sheboygan County slope or dip toward the east at a rate of 35 to 50 feet per mile, the higher figure representing the conditions in the eastern part of the county. The accompanying map represents lines of equal elevation above and below sea level drawn on the top of the Galena-Black River limestone. Measurements of the exact elevation of the top of this formation were obtained at only five places in the county so that it cannot be claimed that the map is absolutely accurate. In order to have any accumulation of oil or gas (granting that there might be sufficient organic matter to have made any), it would be necessary to find a place where the general eastward slope of the formations is reversed for some distance, thus making an arch or anticline. Such an arch would probably have to be at least 50 feet high to retain any quantity of oil or gas. Even the present data are sufficient to make the presence of such anticlines or "structures" very doubtful in this county. The map shows the relation of the area outlined by Mr. Larson to the dip of the formations. The fact then becomes apparent that the northwest end of his area is 300 feet higher than the southeast end! Although he does not claim that oil or gas is present all along the belt outlined

still it is hard to see why it should not have all worked uphill to the northwest end. Furthermore, the formations are at essentially the same elevation at Crystal Lake as at Plymouth and there is known to be no oil at the former place. The supposed pools, therefore, bear an impossible relation to the facts.

Authorities consulted. In addition to the field observations and unpublished notes of the State Survey the following were consulted: Chamberlin, Geology of Wisconsin, 1876; Weidman and Schultz, Water supplies of Wisconsin, Wisconsin Geol. Survey Bull. 35, 1915; Alden, Quaternary geology of southeastern Wisconsin, U. S. Geological Survey, Prof. Paper 106, 1918, Bownocker, Petroleum in Ohio and Indiana, Geological Society of America, Bull. vol. 28, pp. 667 - 672, 1917; De Wolf, F. W. and Mylius, L. A., A new Trenton field in Illinois: Amer. Assoc. Petroleum Geologists, Bull. vol. 4, pp. 43 - 46, 1920; Emmons, Geology of Petroleum, 1921; older reports referred to in these.

Conclusions. Factors favorable to occurrence of oil and gas in Sheboygan County are: (a) the equivalent of the oil- and gas-bearing Trenton limestone of the east is present, (b) the cover of shale is sufficient to have prevented escape provided that anticlinal arches exist, (c) slight shows of oil are known to have been found at Crystal Lake and a few points to the north of the area. Unfavorable factors are: (a) there is not known to be an adequate supply of organic matter in the rocks, (b) there is no evidence of the presence of anticlines or other favorable structure to have prevented oil and gas if present from having escaped up the slope of the formation to its edge in Fond du Lac County to the west, (c) the salt water of deep wells has no necessary relation to the presence of oil or gas, (d)

no shows of gas or oil other than noted above have been found in the many deep wells of Wisconsin and northeastern Illinois which penetrate the Trenton, and (e) Mr. Larson's areas do not fit with known geological facts and are impossible of rational explanation. I, therefore, conclude that although the mantle of drift might conceal favorable anticlines, there is no means except deep drilling of finding where they might be. Judging from adjacent areas, such features are very rare in eastern Wisconsin. Exploration for oil or gas in Sheboygan County is, therefore, like looking for the proverbial "needle in a haystack" without even knowing that there is any needle!

Part II

The divining rod or "wiggletick"

General. The following remarks are not to be construed as an attack on the integrity of Mr. Larson, for I am convinced that he honestly believes in his so-called "instrument" otherwise known as a "divining rod" or "wiggletick". I will, however, quote a few opinions by those best qualified to know about the matter.

History. The use of the divining rod dates from pre-historic times as do many other superstitions. There are references in the Bible which seem to refer to its use at that time and mediaeval literature on it is quite abundant. At the present time many who have not been trained to scientific thought still believe in its efficacy. It is said that during the World War it was employed by the German army. If true, this is its sole recorded official recognition in modern times and is a sad commentary on the intelligence of the officers who allowed its use.

Construction. Several types of rods have been used varying from twigs of trees to the more elaborate metal device weighted with a bottle (probably of oil) which is used by Mr. Larson. All these variations have in common the fact that they are held in the hands of the observer and can be caused to work by either conscious or unconscious muscular movements. There is no possible force other than this that is strong enough to bring about the results. Mr. Larson's use of his "instrument" in a moving car insulated from the ground is alone sufficient proof of this statement.

Tests. Impartial scientific tests of divining rods over areas unknown to the operator but known to others are exceedingly rare. A recent trial in Germany in which three "wigglestick" artists took part is described by D. C. Barton in Bulletin of the American Association of Petroleum Geologists, vol. 7, pp. 427 - 429, 1923. He states that there is an international union of these people called the "Internationaler Verein der Rutenganger". The tests showed no agreement among the three operators and the author observes that "if there were something to the wigglestick, its failure at times to register the presence of a substance might be explained, but that its brilliant registering of substances not present, could not be."

Opinions of others. An editorial in a recent number of the Engineering and Mining Journal-Press (vol. 116, p. 573, 1923) states in reference to all manner of instruments, scientific and otherwise, which have from time to time been put forward in an effort to find buried deposits of minerals

or oil that: "No positive system or machine which will say 'here is a deposit of gold, or there an oil field,' has been devised. Some instruments have been advertised which claim to do this, but they have proved worthless under trial." O. E. Meinzer, government authority on underground waters, states ("The divining rod", U. S. Geological Survey Water Supply Paper 416, 1917): "It is by no means true that all persons using a forked twig or some other device ... are intentional deceivers. Some of them are doubtless men of good character and benevolent intentions." He, nevertheless, advised against depending upon the claims of any operator of a device whose action either cannot be explained by science or is supposed to be a secret.

General conclusion. Evidence derived from a divining rod is worth absolutely nothing. Belief in its efficacy is a survival of the mediaeval belief in the supernatural.

Science Hall,

Jan. 29, 1923.

Mr. A.C. Veatch,
Sinclair Exploration Co.,
New York City.

Dear Mr. Veatch: Yours of the 25th is at hand with enclosed material. Mr. Lentz and I both wish to thank you for your kindness in considering the matter. Hoping that if we find anything else it will prove out better, I remain,
very truly yours,

SINCLAIR EXPLORATION COMPANY
SINCLAIR OIL BUILDING
45 NASSAU, NEW YORK

January 25, 1923.

Mr. F. T. Thwaites,
University of Wisconsin,
Madison, Wisconsin.

Dear Mr. Thwaites:

I have now had an opportunity of discussing with Mr. Hook his trip to Door Peninsula. Of course, the conditions were not such as to enable him to reach complete conclusions on all points, but we are of the opinion that the proposition is not one for the Sinclair Company to follow up.

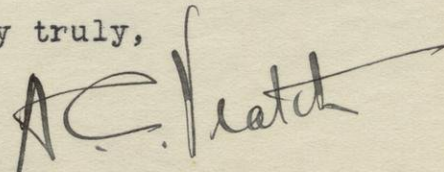
It seems to me, on the whole, more of a proposition for local effort than for a large company.

I am returning herewith the following material with which you kindly supplied Mr. Hook:

- 1 - The report of yourself and Mr. Lentz on your examinations, together with accompanying map.
- 2 - The tracing which Mr. Hook made of your plane-table sheet of the western structure.

We will treat the whole matter as confidential, and you are free to make such other arrangements as you desire.

Yours very truly,



Vice President.

ACV PG

Dec. 2, 1922.

Mr. A. C. Veatch,

C/o Hotel Statler, St. Louis.

Dear Sir: In reply to yours of Nov. 29 we will be glad to talk over matters with you on Dec. 9. We are getting our material into shape for you to look over. Possibly you will be able to decide from that if there is any merit in the proposition. It is now too late to go into the field. Since we would not be able to recognize you it will be best to come up to Science Hall. I might add that we do not want the object of your visit to become known.

Very truly yours,

SINCLAIR EXPLORATION COMPANY
SINCLAIR OIL BUILDING
45 NASSAU, NEW YORK

November 29, 1922.

Mr. F. T. Thwaites,
University of Wisconsin,
Madison, Wisconsin.

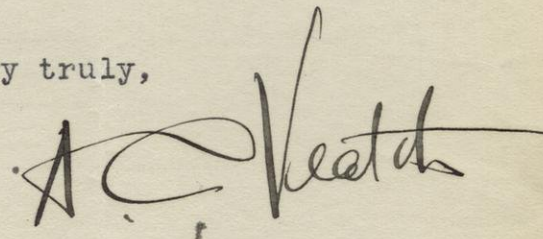
Dear Mr. Thwaites:

Referring to your letter of November 18th:

I am going to St Louis for the meeting of the American Petroleum Institute, and, if it is convenient for you, will come to Madison on Saturday, the 9th, arriving there on the one o'clock Chicago and Northwestern train. I fear it is too late to get in the necessary field work this year, but this will depend upon the weather man.

Please advise me "c/o Hotel Statler, St Louis" whether the afternoon of the 9th will be agreeable to you for a conference on this matter.

Yours very truly,

A handwritten signature in dark ink, appearing to read "A. C. Veatch". The signature is written in a cursive style with a long, sweeping horizontal line extending to the right.

ACV PG

Science Hall,

Nov. 18, 1922.

Mr. A.C.Veatch,

Sinclair Exploration Company,

Sinclair Oil Bldg.,

45 Nassau, New York City.

Dear Sir: In reply to yours of Nov. 9 regarding development in Door County, Wisconsin we agree to your terms except that we wish your cooperation in securing leases so that there might be no misunderstanding over the areas desired. We have not as yet found favorable structure over as much area as 50,000 acres but there is fully that much adjacent to known structures which might prove of some value. If you decide to make an examination in the field it would have to be made within a very few weeks or else postponed until spring on account of the heavy snowfall in that area.

Very truly yours,

SINCLAIR EXPLORATION COMPANY

SINCLAIR OIL BUILDING

45 NASSAU, NEW YORK

November 9, 1922.

Mr. F. T. Thwaites,
Science Hall,
University of Wisconsin,
Madison, Wisconsin.

Dear Sir:

Referring to your letter of October 21st regarding the project for development on the Door Peninsula:

You have an idea, for which, if the work is undertaken, you deserve compensation. This is fundamental and there is no difference on this point, but we find the participation suggested in your letter for you and your associate, too high.

We have had a number of deals in which large blocks of land have been brought to us, on which the person offering the land not only had done sufficient geologic work to locate promising structures, but had oil leases covering the promising areas, and the usual compensation in these deals to the person proposing the business has been from one-tenth to one-eighth of the net profits.

For example, Mr. E. E. Ellis, Chief of the Land Department and head of the geologic work of the Tennessee Coal and Iron Company, brought to us a project involving over 50,000 acres in Alabama, on which he and his associates had made geologic examinations that had convinced him the area was valuable for oil, and, following which, he had secured leases in proper form

on a one-tenth royalty, without bonuses, utilizing agents and attorneys specially trained in this business. This land was in a compact block and the whole project was ready to proceed with without special demands on the time of our own organization. We concluded an agreement with Mr. Ellis under which his compensation was fixed at $12\frac{1}{2}\%$ of the net profits, and he turned over all of his leases and rights, as well as the large amount of geological data he had on this area.

In your case you have only the idea, and the step between that and the point where drilling could be commenced is a long one.

We suggest the following method of meeting the present situation:

Subject to our preliminary examination of the project being satisfactory, we will agree to:

- 1 - Pay you $2\frac{1}{2}\%$ of the net profits of the development of the land secured under this project.
- 2 - Refund to you the \$300 you and your associate have spent on this work.
- 3 - Pay the reasonable expenses of you and your associate, with a reasonable limit to be agreed upon, in securing the necessary leases, without bonuses, and, in addition, pay you a fee of 10 cents an acre for all leases secured along the lines we lay down.

We feel it would be necessary to have at least 50,000 acres under lease to justify a wildcat effort in this region, and the fee mentioned in No. 3 would be payable on a less quantity only if we decide to go ahead on a smaller acreage.

3.

If this general basis for an agreement is satisfactory to you, please advise me, and, subject to the approval of our Board, we will arrange for the preliminary investigations and go into the details of the matter with you.

Yours very truly,

A. C. Veatch,

ACV PG

SINCLAIR EXPLORATION COMPANY

SINCLAIR OIL BUILDING

45 NASSAU, NEW YORK

October 16, 1922.

Mr. F. T. Thwaites,
Science Hall, University of Wisconsin,
Madison, Wisconsin:

Dear Sir:

Dr. Leith has very kindly advised me that your personal investigations in Eastern Wisconsin have led you to the conclusion that the region is worthy of a test for petroleum.

Please advise me:

1 - The remuneration you have in mind for yourself, in case we should decide to investigate the matter with a view to drilling a test well, or wells, in the event the conditions should, in the opinion of our staff, warrant such a test.

2 - Whether the region you have in mind has been leased for oil development, and, if these leases are in force to-day, on what terms they are held, and by whom.

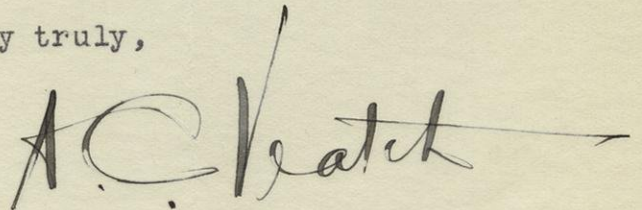
3 - Whether, in your opinion, it would be possible to secure the adhesion of the old land owners to a "pooling" of their oil rights for a large aggregate area, in order that development could be carried on without the limitations which are imposed by a lot of separate leases.

If there are many owners in the region you have in mind, as I imagine is the case, it would not be feasible to agree to drill (or, in lieu of drilling, to pay a heavy rental) on each of the tracts. The whole area should be held by a covenant to

drill a test well at a point in the general region which the advisors of the lessees think the most advantageous for the production of oil. After this initial test, the development requirements would apply to the land as a whole, and not to the individual tracts.

Under such a plan the royalty would be divided among all of the land owners concerned, in the proportion that the acreage owned by each landlord bears to the total acreage. This plan is capable of being carried out by a number of individual agreements, but it would, perhaps, be simpler for the landlords to form a sort of "Co-operative Land Owners Association", which would own all the oil rights, and, in turn, lease the whole block to a company for the purpose of testing the ground. The latter plan would also have the advantage of giving the landlords a compact executive committee for dealing with the company and seeing that it carried out the development requirements of the agreement entered into.

Yours very truly,

A handwritten signature in cursive script that reads "A.C. Hatch". The signature is written in dark ink and has a long horizontal flourish extending to the right.

ACV PG-

STRUCTURE AND OIL POSSIBILITIES

IN DOOR COUNTY, WISCONSIN.

Exploration by F.T. THWAITES and R.C. LENTZ
1922.

WGNHS OPEN FILE REPORT

1922-02

OIL POSSIBILITIES EAST OF MANISTIQUE, MICHIGAN

F. T. Threlton

June, 1929

OIL POSSIBILITIES EAST OF MANISTIQUE, MICHIGAN

Area examined. The area described in the following report lies along the Soo Line Railway east from Manistique, Michigan to Seul Choix Point on Lake Michigan. A large part of this district belongs to Messrs. Fredrickson and Calvert of Rockford, Illinois who had leased the oil rights to Mr. Joseph Olson of the same city. Their tract is on the lake shore and varies in width from less than half a mile at the west to over two miles at the east.

Previous investigations. The area has been examined by several geologists of the Michigan Geological Survey, most of whose reports have not been published, and by E. E. White of Graham, Texas, whose report was loaned to the writer. Some information was obtained from the geological map of Michigan published by the Michigan Geological Survey in 1916.

General geology. The tract under lease is almost wholly covered with sand dunes. Rock outcrops are confined to a few low ledges along the shores of Lake Michigan and some of the inland lakes. On account of high water in all the lakes at the time of visit (May 30 to June 1) it was impossible to see more than a fraction of the known outcrops. A small tract between Gulliver and McDonald lakes is underlain by rock at slight depth. The bed rock is the Niagaran Series of dolomites or magnesian limestones. These rocks have been divided into a number of minor

divisions by the Michigan Geological Survey, but the detailed descriptions of these have never been published. The maximum thickness of the Niagaran rocks is thought to be about 375 feet in this vicinity. Underlying the Niagaran is about 630 feet of shales and shaly dolomites to which the Michigan geologists apply a number of names but which are more easily described under the term, Richmond Group. Beneath the shales is nearly 300 feet of dolomite, called the Trenton Group. Below the Trenton, sandstone and some shale extend to the greatest depth (1710 feet from surface) which the drill has reached. If the full thickness of these rocks had been penetrated, hard rocks such as granite, quartzite, or slate would have been found because these rocks outcrop farther west and their surface is known to slope or dip down to the east.

Structural geology. The sedimentary rock formations of the northern Peninsula of Michigan dip to the east or south in the vicinity of Manistique. If they could be followed beneath Lake Michigan, it would be seen that this dip carries them far below the surface of the Southern Peninsula, for very deep wells on the opposite side of the lake strike them at a depth of several thousand feet. The covering rock formations of the Southern Peninsula are not present in the Northern Peninsula having either (a) never been deposited or (b) been destroyed by ages of exposure to wind and weather (erosion). It is positively known that the oil-bearing formations of the Muskegon and other Southern Peninsula fields are not present on the north shore. They reach the surface beneath Lake Michigan. Two distinct features, however, suggested the possible occurrence of oil near Manistique: (a) the oil residue or gum in some of the rocks, particularly the Trenton dolomite, and (b) the low anticline or up-fold which the Michigan

geologists found on Seul Choix Point. The position of the boundary lines between formations shown on the 1916 map suggests that this fold passes through the tract belonging to Messers. Calvert and Fredrickson. These lines show that the boundary between the "Engadine formation" and the underlying "Manistique formation" (divisions of the Niagaran Series used at that time) curves across Seul Choix Point and to the north makes a re-entrant angle near Whitedale. This mapping indicates an anticline or up-fold whose axis is inclined or "pitches" down to the southeast, thus forming the point, with north of it a syncline or down-fold whose axis pitches in the same way. These structural features were apparently worked out by observing the dip of the layers and must of necessity have been shown only in a rather generalized manner on the map of the state.

Method of survey. The short time available for the survey caused the writer to concentrate on the problem of the existence of a closed up-fold or dome on or near to the property in question. The most accurate way of finding such a feature, or "structure" as it is known to oil men, is to find the elevation of a certain definite key bed or layer in the surface formations and then map its position by means of lines of equal elevation (contours) drawn on its surface. The resulting "structure map" is what the topography of the land would be if it were stripped of the formations overlying this layer. In order to be certain of everywhere recognizing the same layer it is necessary to examine a considerable

thickness of the rocks at a number of places. In a region of such low hills as the country examined it is difficult to get many deep exposures. There is, however, a decided tendency for the surface of the ground to be parallel to a given layer in the rocks. Not all slopes are what geologists call "dip slopes", for it is easily seen that others cut across the layers forming a flight of steps in which the treads have largely been obliterated by soil which was deposited when the glacier melted. By combining the evidence of dip slopes with examination of the available sections the writer concludes that he followed the base of what the Michigan Survey now calls the Manistique formation over most of the area examined. The contact of the Manistique (as now defined and not as shown on the 1916 map) and the underlying Burnt Bluff formation is shown in the accompanying photographs, figures, 1, 2, and 3. The writer cannot be certain after such brief examination that this is the exact contact which the Michigan geologists had in mind and which is noted in their log of the exploration hole, but nevertheless he is convinced that the elevations he measured are all of essentially the same layer. The elevations were determined with an aneroid barometer whose readings were corrected by the method devised by Lahee. The writer has had several years experience with this method and in this case found that his corrected readings checked very well with railroad elevations which were not known at the time of survey. It is unlikely that any of the results are in error by more than 10 feet and for the purpose it did not seem justifiable to use more expensive



Figure 1.- ~~Key~~ bed followed to make structure map. Exposure in NW. Sec. 26, T. 42, R. 15, W. Layers above the white bed are filled with chert and silicified fossils and those below the head of the hammer have enither.

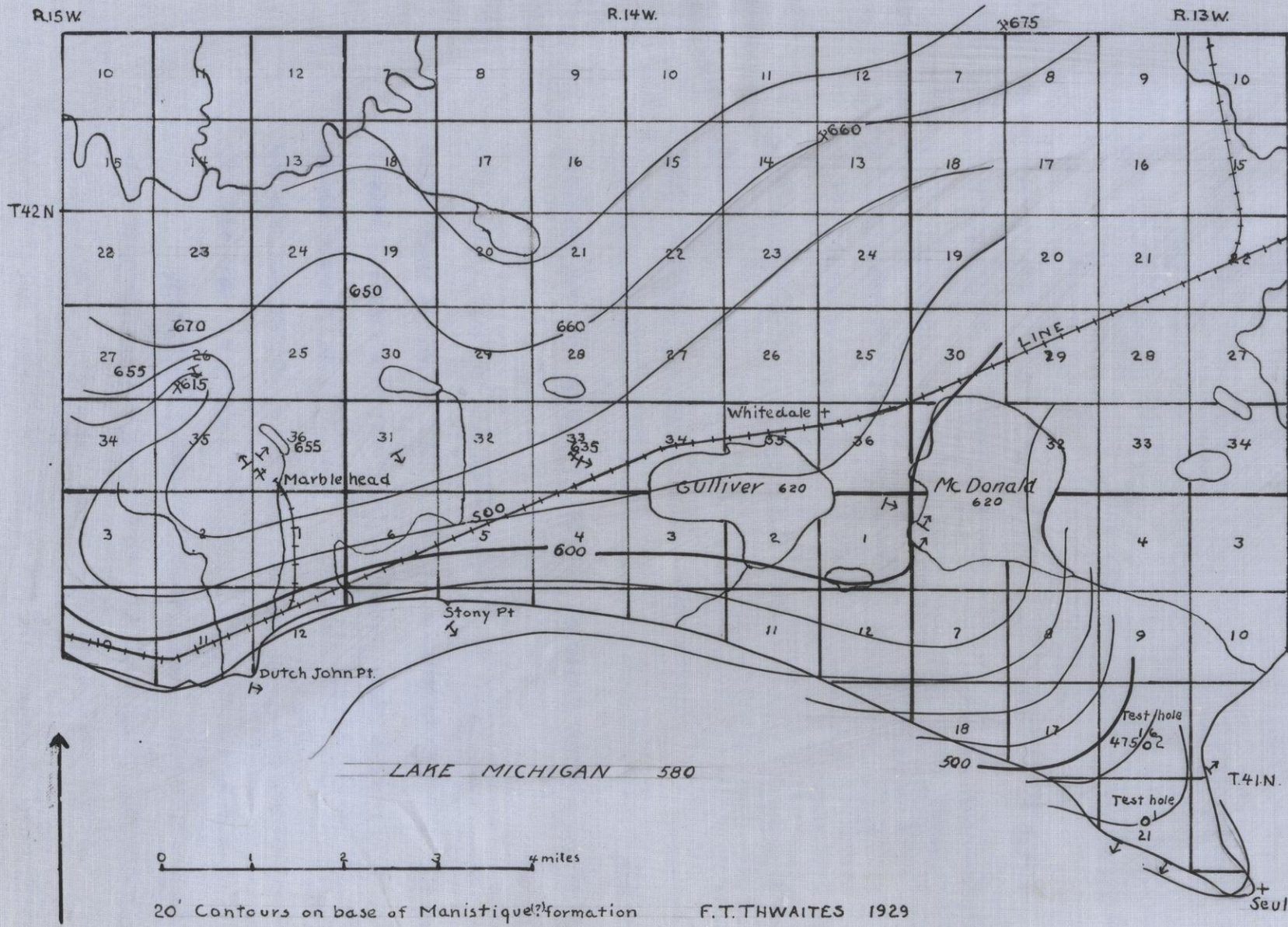


Figure 2.- Key bed followed to make structure map. Quarry near center Sec. 33, T. 42, R. 14 W. Contact is between upper gray fossiliferous layers and lower white dolomite. This line is taken to be the same as that shown in Figure 1.



Figure 3.- Quarry of White Marble Lime Co. in Sec. 26, T. 42, R. 15 W.
Some fossiliferous dolomite at the far side is taken to be the bottom of the fossiliferous layers used as a key bed. On this assumption there is a reversal of the marked southeasterly dip shown at the left in this picture between this quarry and the hills in the background near the old quarry.

methods. The writer did not measure the degree of dip of the layers but noted only the direction of this dip. The dips had previously been measured by White and most of the dips observed in the area he did not visit proved to be so low that exact readings were impossible. Such low dips are decidedly unreliable since in a deep exposure like the quarry at Manistique it is seen that the layers are not of exactly the same thickness at all points and that dips measured on one layer do not apply to other layers. By combining the aneroid barometer readings on the base of the dolomite which carries abundant silicified corals and is underlain by non-fossiliferous dolomite the accompanying map (Pl. I) was prepared. This map shows that the anticline of Seul Choix Point pitches to the southeast although the strata are level at the lighthouse. It is not a closed dome and therefore could not contain any oil. The same conclusion was reached by W. I. Robinson of the Michigan Geological Survey who stated this in a letter to the writer dated August 8, 1922. The present writer concluded that the Seul Choix anticline is not as pronounced on its north side as the 1916 map would indicate. The layers are level at Whitedale and no different than the gently dipping beds on the southwest shore of McDonald Lake. The writer found no evidence that the anticline extends as far west as Gulliver Lake. If the contact followed in exposures is not the same as the base of the cherty dolomite in test Hole No. 2, then the pitch of the fold may be more or less than that shown, but the general form of the structure cannot be much different. The writer has been very conservative in



drawing conclusions from dips alone, for it has been his experience that these change in short distances and are therefore misleading. West of Gulliver Lake and north of the Soo Line there is no evidence of anything but a very gentle southeasterly dip except in the vicinity of Marblehead quarries. Dutch John and Stony Points (fig. 4) both show southeasterly dips at very low angles. The old Marblehead quarry indicates the top of a very low dome. The beds in the new quarry, as shown in figure 3 (p. 7), are strongly inclined to the southeast. If the layer at the top of the southeast side of the new quarry is actually the same as that in the old quarry, a rise of about 40 feet to the southeast is demonstrated. So little was seen of this layer, however, that this statement can be considered only as a tentative conclusion which might be revised upon more detailed study. The writer concludes that the evidence available does not prove that any closed dome or anticline exists in the region studied. If there is any real dome at the old Marblehead quarry, it is very small and almost wholly open to the northeast. There is nothing in the way of excessive fracturing of the rocks to suggest that any domes are concealed beneath the sand dunes. The writer feels that his exploration was adequate for the area under lease and that it demonstrates that no large dome can exist in the Niagaran Series within that tract.

Subsurface geology. The subsurface geology is fairly well known from the log of Test Hole No. 2 of the Schoolcraft Development Syndicate drilled in 1922. This hole is located at the saw mill in SW. part of NW. 1/4 of SE. 1/4 of sec. 21, T. 41, R. 13 W. at ele-



Figure 4.- Stony Point in Sec. 8, T. 41, R. 14 W. These rocks contain silicified fossils. They overlie the thinner layers at the key bed by an undetermined distance. The southeasterly dip is very faint and does not suggest that any dome exists in this vicinity.

vation about 625. Both location and elevation are erroneous in log furnished by the Michigan Geological Survey. The log may be abbreviated as follows:

	Thickness Feet	Depth Feet
Niagaran Series		
Manistique formation - dolomite, gray, cherty	150	150
Burnt Bluff formation - dolomite, chert only near top	155	305
Mayville formation - dolomite, light gray	70	375
Richmond Group - shale, blue, brown, and red; some dolomite layers	630	1005
Trenton formation - dolomite, brown and gray	197½	1202½
Lower Magnesian formation - dolomite, gray	90	1292½
Jordan formation - sandstone	32½	1325
Trempealeau formation - dolomite, red, and shale, green	47½	1372½
Mazonian formation - sandstone, dolomitic	127½	1500
Dresbach formation - sandstone, some shale	210	1710

The nomenclature of the formations in the lower part of the hole has been changed to agree with that worked out by the writer in Wisconsin and Illinois. The log demonstrates that the Trenton formation, which is oil bearing in Ohio, Indiana, and Illinois, is present in this area. A single log tells nothing of its structure which may not be exactly parallel to that of the surface strata on account of horizontal changes in thickness. The Trenton is believed to reach the surface only a little over 20 miles north of the area examined. Attention should be called to the small thickness of the Trenton and to the absence of the St. Peter sandstone beneath, the latter a fact not recognized by the Michigan geologists.

Oil occurrence. Areas where the Trenton carries oil have been mentioned above. In addition several small and apparently non-commercial wells were once drilled to the Trenton on Manitoulin Island, Ontario. The Trenton of the area investigated is capable of holding oil if such is present. Oil is derived from organic matter buried in the reservoir rock or in adjacent formations, mainly black or brown shales. The log of Hole No. 2 shows 15 feet of brown and presumably oily shale immediately above the Trenton. A source of oil is therefore probably known. Oil residue is known on the outcrop of the Trenton in many places in northern Michigan. These facts make the occurrence of oil in the district under lease a possibility.

Previous exploration. Exploration by some local parties under the name of the Schoolcraft Development Syndicate was begun in 1921 apparently upon data obtained from the Michigan Geological Survey. After work had been started, E. E. White, a geologist of Graham, Texas, appears to have been employed. His investigations seem to have been detailed but to have been confined to the district east of McDonald Lake. The writer has made much use of his report. Two holes were drilled as shown on the map, but no record is available of the first or southern one. The foreman at the saw mill now located at the second test informed the writer that fresh water "shot over the top of the derrick." W. I. Robinson of the Michigan Geological Survey also informed the writer that nothing but fresh water was found. The log of the test hole says nothing about oil residue or bitumen in the samples of cuttings. This log states that fresh water was found at 1225 to 1230 feet in the Lower

Magnesian and at 1370 feet at the base of the Trempealeau formation. It may be presumed that all the lower sandstones also contain fresh water. It is not apparent that water was found in the true Trenton.

Underground water circulation. A factor vital to the occurrence of oil in commercial amounts is moving underground water. This fact was entirely ignored in former studies of the district but has become known as a result both of (a) studies in the Rocky Mountain oil fields and (b) experiments in the laboratory. The rocks in which oil is found were almost without exception deposited under the sea as is shown by the remains of sea animals like corals which they contain. When first upraised from the sea, these rocks contained salt water. Rain fell upon the upraised edges of the different formations and gradually washed out the salt water or forced it toward some lower outlet. Around Chicago fresh waters have reached a depth of over 1500 feet below sea level. In Test Hole No. 2 they were found 1085 feet below sea level. This process has gone farthest in the more porous layers and it is in such that oil tends to concentrate from the adjacent dark colored rocks. At great depths and far from the outcrop where fresh waters can enter oil is found floating on top of salt water. This is the condition in almost all productive oil fields. Nearly all such commercial fields lie far from outcrops of the reservoir rocks. The only exceptions occur where (a) the motion of underground waters is toward the outcrop, (b) a very pronounced dome is present in which moving waters can pass below the oil and leave a portion of the original content undisturbed, and (c) a porous oil reservoir is not connected with the outcrop so that

waters cannot flush it. The area investigated is relatively near the outcrop of the Trenton and the test holes definitely prove that fresh waters have penetrated the more porous layers beneath the entire area under lease. No large dome is known or is probable in which oil might escape flushing and there is no means to tell where any local porous areas unconnected with the general water circulation exist. The writer concludes that the finding of commercial oil in the area investigated is highly unlikely although he cannot be positive that it is impossible.

Summary. The following table summarizes the factors which control possible oil accumulation in the area:

Oil reservoir	- Trenton dolomite-limestone	- favorable
Source rock	- Base of Richmond shales	- favorable
Covering rock	- Richmond shales	- favorable
Structure	- No domes known or likely	- unfavorable
Water circulation	- Fresh water under high pressure	- Very unfavorable

Recommendations.- It would be possible to check up on structure determinations from surface evidence by drilling small test holes about 400 feet deep to the top of the Richmond Group which appears to be marked by a red shale. Such holes should be spaced at least a half mile apart in a north-south series which should be located one to two miles apart in an east-west direction. If even one such series of holes failed to demonstrate a dip toward the north, this project should be abandoned. In view of the extremely unfavorable results of

the former exploration, the writer strongly recommends the abandonment of the lease. If it should, nevertheless, be decided to drill a well through the Trenton, it should be located somewhere on the south shore of Gulliver Lake so that land owners might take it for a fresh water artesian well if, as seems probable, it gives the same results as the two former tests.

Respectfully submitted,

Consulting geologist
June 1929