Correspondence - L - 1. 1924-1947

May 7, 1941

Mr. E. J. Rogers
President & Gen'l Manager
Layne-Northwest Company
709 No. Eleventh Street
Milwaukee, Wisconsin

Dear Mr. Rogers:

In reply to yours of May 6, we wish to advise you that we still hold to the view that rotary test holes are apt to be misleading. This is particularly true where layers of sand and gravel occur between layers of till. The mud which is circulated is mixed with the material washed up in such a way that it is impossible to be sure what was penetrated. In solid layers of sand and gravel, where you can be sure the mud was actually added and not from the ground, it is true that satisfactory results are obtainable. An example of the failure of rotary tests is the divergent results of two such holes at Williams Bay. We did not advise the people at Fontana to refuse payment, but advised that more accurate results are obtainable with cable tools. We have also compared rotary cuttings from rock wells with adjacent cable tool samples, to the great disadvantage of the former.

Our letter of October 2, 1940 stated:

> "We advise that all test holes in drift be drilled with cable tools. There is so much mud in the samples that it is impossible to tell whether they are till or stratified sand. However, it is clear that no coarse gravel is present.
>
> "Conclusions are most uncertain with rotary samples."

Now you must realize that the drillers have access to other data than the samples. We still decline to pass on the prospect on the basis of rotary samples.

Very truly yours

WISCONSIN GEOLOGICAL SURVEY
By

F. T. Thwaites/lrk

Geologist, Well Records

LAYNE-NORTHWEST COMPANY

WELL WATER SUPPLY CONTRACTORS
LAYNE DEEP WELL TURBINE PUMPS

PUMP & WELL
EQUIPMENT FOR
MUNICIPALITIES
INDUSTRIES
RAILROADS
MINES & IRRIGATION

AFFILIATED WITH
LAYNE & BOWLER, INCORPORATED
MARQUETTE BUILDING
709 NORTH ELEVENTH STREET
MILWAUKEE, WIS.

FACTORIES
MEMPHIS, TENN.
HOUSTON, TEXAS
LOS ANGELES, CAL.

May 6, 1941

Mr. F. T. Thwaites
Geologist
Gelogical & Natural History Survey
Madison, Wisconsin

Dear Mr. Thwaites:

We recently had occasion to drill a test well for a subdivision near Fontana, Wisconsin; namely, Glenwood Springs. The test hole was actually drilled by our Layne Western Company of Chicago. The equipment was especially designed for test work and operated by a crew of men who are the regular test crew of Layne Western Company.

The reason for writing you today is that the customer advised us that you told them a rotary rig was not satisfactory for drilling test holes. As a consequence they have refused to pay us for the work. Of course we do not know whether or not the statement was made, but our position in the matter is that if a rotary rig is used and in the hands of men who know their business, accurate results can be obtained.

Our organization throughout the country does most of its work on a guaranteed basis where we must assume the responsibility for the quantity of water.Accordingly, we must have a good "batting average" with a minimum of mistakes. Otherwise we could not exist.

Our Layne Western Company which operates in several states in the midwest including Kansas, Nebraska, part of Oklahoma, Missouri, Illinois, and Iowa, employs only rotary drilling machines. The work is in the hands of men who are thoroughly skilled. On the basis of their findings we proceed to construct wells on a guaranteed basis. It was one of these units which was used at Glenwood Springs. Throughout the south it would be practically impossible to use anything but a rotary drilling machine for test purposes where wells are drilled in unconsolidated formations to depths as deep as several thousand feet. For instance, the City of Houston, Texas, where we furnish the entire city with water, the wells are deep as 2500 feet. In Paris, France, they are as deep as 3,000 feet. Jamaica, New York, which is the largest municipality obtaining its entire supply of water from wells, is supplied entirely fromwells drilled by our company. These wells are several hundred feet deep. We might mention a great many other large installations; in fact, thousands of them throughout

how you must realize that the drillers have
axes to grind other than the sample. We will
decline to pass on the prospect on the basis
of rotary samples.

the south where not only the wells themselves, but the test holes, were drilled by the rotary method and accurate results obtained. We recently obtained a 20,000 GPM supply just north of Memphis for a Powder Plant, and 25,000,000 gallons per day for the Hollingsworth & Whiteney Paper Company at Mobile. All tests were drilled by the rotary method. Throughout the south practically all test drilling is done by the rotary method and very excellent results obtained.

We are enclosing a cut of a typical rotary test rig used in the south. It happened to appear in one of our monthly magazines.

Layne-Northwest Company probably uses fewer rotary rigs for test drilling than our other companies. This, however, is due to the fact that our unconsolidated formations are very shallow and the cost of setting up a rotary rig for test holes in the neighborhood of 100 feet is often greater than that of a cable tool machine. We, however, do not hesitate to base our guarantees on our findings in rotary drilling.

Please understand that this communication is one of explanation of our position rather than that of finding fault with anyone. We feel it our obligation to advise those interested in any advances which we may make, as a great deal more can be accomplished by cooperation than fault finding. We feel sure that the results of the test hole which we drilled at Glenwood Springs was fully as accurate as we could obtain with a cable tool machine. In fact, there were some advantages to using the rotary drilling machine.

We hope that you will feel free at any time to ask us about matters relating to the development of water supplies in our district. It is the hope and desire of this company that we can improve construction of wells and methods of drilling them by cooperating with the various State Departments. It is with this in mind that we solicit your cooperation.

Yours ~~very~~ truly,

LAYNE-NORTHWEST COMPANY

E. J. Rogers

President & General Manager

EJR/dk
3289

In reply to yours of May 6 we wish to advise you that we still hold to the view that rotary test holes are apt to be misleading. This is particularly true where layers of sand and gravel occur between layers of till. The mud which is circulated or mixed with the material washed up is of such a body that it is impossible to be sure what was penetrated. In solid layers of sand or gravel, however, you can be sure the mud was actually added and not from the ground. It is true that satisfactory results are obtainable. An example of the failure was the divergent results of two such holes at Williams Bay. We did not advise the people at Fontana to refuse payment but I do think that more accurate results are obtainable with cable tools. We have also compared rotary cuttings from rock wells with adjacent cable tool samples to the great disadvantage of the former.

Our letter of Oct 2, 1940 stated:

"We advise that all test holes in drift be drilled with cable tools. There is so much mud in the samples that it is impossible to tell whether they are till or stratified sand. However, it is clear that no coarse gravel is present." "Conclusions are most uncertain with rotary samples"

LAYNE-NORTHWEST COMPANY

WELL WATER SUPPLY CONTRACTORS
LAYNE DEEP WELL TURBINE PUMPS

PUMP & WELL
EQUIPMENT FOR
MUNICIPALITIES
INDUSTRIES
RAILROADS
MINES & IRRIGATION

AFFILIATED WITH
LAYNE & BOWLER, INCORPORATED
MARQUETTE BUILDING
709 NORTH ELEVENTH STREET
MILWAUKEE, WIS.

FACTORIES
MEMPHIS, TENN.
HOUSTON, TEXAS
LOS ANGELES, CAL.

May 21, 1942

Wisconsin Geological Survey
Madison, Wisconsin

Attention: Mr. F. T. Thwaites, Geologist
In charge of Well Records

Gentlemen:

We have just received your communication of the 19th.

We expect to complete the Camp McCoy wells within the next two or three weeks and will try and assemble all the information and have it in your hands at one time as you would probably desire to have it submitted to you in this manner.

Some of these wells were drilled by others but we will try to include this information and get all of it to you. This likewise applies to the Badger Ordnance Works.

We will check to see what happened to the Prairie du Sac samples if you have not as yet obtained them. We find it quite difficult to impress upon our drillers that samples are important. Sometimes they realize they are until they get ready to move, then someone sets them aside and forgets to send them in. We trust this did not happen to Prairie du Sac. We have a careful record of the formations as we determined them. Incidentally, the well was a very excellent producer, the capacity of same being about 50 gallons per foot of drawdown.

You will hear from us before long.

Very truly yours,
LAYNE-NORTHWEST COMPANY

Edw. J. Roger
President & General Mgr.

EJR/dk

LAYNE-NORTHWEST COMPANY

WELL WATER SUPPLY CONTRACTORS
LAYNE DEEP WELL TURBINE PUMPS

PUMP & WELL EQUIPMENT FOR MUNICIPALITIES INDUSTRIES RAILROADS MINES & IRRIGATION

AFFILIATED WITH
LAYNE & BOWLER, INCORPORATED
MARQUETTE BUILDING
709 NORTH ELEVENTH STREET
MILWAUKEE, WIS.

FACTORIES
MEMPHIS, TENN.
HOUSTON, TEXAS
LOS ANGELES, CAL.

May 3rd, 1943

Mr. F.T.Thwaites
Geologist in charge of WellRecords
Geological and Natural History Survey
University of Wisconsin
Madison, Wisconsin

Dear Sir:

Mr. Rogers, President of Layne Northwest Company, was talking to Mr. Louis Watry the other day, and the subject came up that you had mentioned to Mr. Watry the fact that we had not been sending in logs of all of the wells that we have been drilling.

Mr.Rogers brought this to my attention as it is one of my duties to forward logs of completed wells to the State Board of Health as required by the Wisconsin Well Drillers Code.

We would appreciate very much your advising if there are any well logs on wells drilled by our company that you would like, or any additional information that we can supply you. It is our desire to cooperate with you in every way possible, as we sincerely appreciate all of the cooperation which you have given us in furnishing information on construction details that have proven of great value to us.

Perhaps it would be best that each time a log is made up for the State Board of Health, that we make up a copy and forward same to you, and should you like us to do so we would appreciate your so advising.

The writer anticipates being in Madison some time in the near future, and will call at your office at that time.

Very truly yours,

LAYNE-NORTHWEST COMPANY

Geo M Galloway
Field Engineer

GMG/ga

Dear Mr Galloway:

In reply to yours of the 3rd I think the matter is largely a misunderstanding based on my failure to find any log of the Prairie du Sac village well I had been asked by the engineer to prepare a board for the well but later the idea was given up.

Meantime I had asked several times at Mr Wahl's office for the log. I do not recall any other times that I failed to get the information either there or directly from you: We certainly appreciate greatly the samples and records we have been getting. I doubt if it is necessary ~~to~~ or desirable to fill out a duplicate of the Board of Health logs, but thank you for the offer. I will be glad to have you call at the office any time you are in town. However, My plans for the summer are vague. I will probably be touring Players only then.

May 6, 1943

Mr. Geo. M. Calloway
Layne-Northwest Company
709 North Eleventh Street
Milwaukee, Wisconsin

Dear Mr. Calloway:

In reply to yours of the 3rd, I think the matter is largely a misunderstanding based on my failure to find any log of the Prairie du Sac village well. I had been asked by the engineer to prepare a board for this well, but later the idea was given up. Meantime I had asked several times at Mr. Watry's office for the log. I do not recall any other time that I failed to get the information either there or directly from you. We certainly appreciate greatly the samples and records we have been getting. I doubt if it is necessary or desirable to fill out a duplicate of the Board of Health logs, but thank you for the offer. I will be glad to have you call at the office any time you are in town. However, my plans for the summer are vague. I will probably be teaching Physics only then.

Very truly yours,

WISCONSIN GEOLOGICAL SURVEY
By

F. T. Thwaites, Geologist
In charge of Well Records

FTT/DMD

PHONE MARQUETTE 3271

World's Largest Water Developers

LAYNE-NORTHWEST COMPANY

WATER SUPPLY CONTRACTORS

MARQUETTE BUILDING
709 NORTH ELEVENTH STREET
Milwaukee, Wisconsin

April 24, 1944

Wisconsin Geological Survey
Madison 6, Wisconsin

Gentlemen: Subject: Hillpoint Cooperative Creamery

We are sorry to learn that you have not received the samples from the above well. We checked our railroad express receipt and apparently they made an error and sent these to the Hillpoint Creamery. They were brought into the office by the writer and sent from here to your Department using one of your Geological Survey shipping tags. A notation was made that these samples were from Hillpoint Creamery well in order that you might identify them when you received them. We will write to the Hillpoint Creamery and if they were missent, as this receipt indicates, we will ask them to forward same to you.

Yours very truly,

LAYNE-NORTHWEST COMPANY

Edw. J. Rogers

President & Gen'l. Mgr.

EJR:at
Enc.

April 24, 1944

COPY

Hillpoint Cooperative Creamery
Hillpoint, Wisconsin

Gentlemen:

The writer took the well samples from your new well to Milwaukee and they were shipped express, April 14, presumably to the Wisconsin Geological Survey. They were consigned to Wisconsin Geological Survey but apparently the express agency noted that a notation was made on the back stating that these were from your well and apparently they, inerror, returned these samples to you. The Wisconsin Geological Survey has stated that they have not as yet received them, hence it is possible that you have received them at Hillpoint. If so, would you kindly express these samples to the WisconsinGeological Survey, Madison 6, Wisconsin.

Yours very truly,

LAYNE-NORTHWEST COMPANY

Edw. J. Rogers.

President & Genl. Mgr.

EJR:at
CC WGS

(6)

April 21, 1944

Mr. Edw. J. Rogers
President & Gen'l Mgr.
Layne-Northwest Company
709 North Eleventh Street
Milwaukee, Wisconsin

Dear Sir:

In your letter of April 14 you advised that well samples were being sent from the Hillpoint Cooperative Dairy well at Hillpoint, Wis. Since these have not yet been received, we thought it best to advise you of that fact.

Very truly yours

WISCONSIN GEOLOGICAL SURVEY
By

LMV

PHONE MARQUETTE 3271

World's Largest Water Developers

LAYNE-NORTHWEST COMPANY

WATER SUPPLY CONTRACTORS

MARQUETTE BUILDING
709 NORTH ELEVENTH STREET
Milwaukee, Wisconsin

April 14, 1944

Wisconsin Geological Survey
Madison, Wisconsin

Gentlemen:

We are sending you express, samples of formation taken during the drilling of a well for the Hillpoint Cooperative Dairy, Hillpoint, Wisconsin.

Yours very truly,

LAYNE NORTHWEST COMPANY

Edw. J. Rogers

President & Genl. Mgr.

EJR/bh

PHONE MARQUETTE 3271

World's Largest Water Developers

LAYNE-NORTHWEST COMPANY

WATER SUPPLY CONTRACTORS

MARQUETTE BUILDING
709 NORTH ELEVENTH STREET
Milwaukee, Wisconsin

May 16, 1944

Wisconsin Geological Survey
Madison 6, Wisconsin

Gentlemen:

We are at a loss to understand what happened to the samples from the Hillpoint Cooperative Creamery well. We communicated with the Hillpoint Creamery and they were unable to locate them. These samples were shipped from this office with a shipping tag which accompanies sample bags. We would suggest that you request the local Express Company office to see if they cannot be located and we are asking the Express Company here to trace the shipment.

Yours very truly,

LAYNE-NORTHWEST COMPANY

Edw. J. Rogers

President & Gen'l. Mgr.

EJR:at

May 10, 1944

Mr. Edw. J. Rodgers
President & Gen'l Mgr.
Layne-Northwest Company
709 North Eleventh Street
Milwaukee, Wisconsin

Dear Sir:

With further reference to your letters of April 14 and 24, we wish to inform you that we have not yet received the samples from the Hillpoint Cooperative Creamery well.

Very truly yours

WISCONSIN GEOLOGICAL SURVEY
By

LMV

May 24, 1944

Railway Express Agency
527 North Fourth Street
Milwaukee, Wisconsin

Attention General Agent:

Dear Sir:

Replying to your communication of May 22, with reference to a shipment to the Wisconsin Geological Survey. We are attaching the blanks for loss and damage claim to a copy of this communication, which will be mailed to the State Geological Survey.

As far as the actual value of the samples is concerned, it is nil. However, the value from the standpoint of records of underground formations, is quite valuable, and consequently, it is unfortunate that the shipment has been lost. The package which was called for by your driver at this office, was addressed to the Wisconsin Geological Survey, Madison, Wisconsin, on one of their tags. Reference was made on the back of the tag indicating that the enclosed samples were obtained at the Hillpoint Creamery, Hillpoint, Wisconsin, and it was our thought that they may have been mis-sent.

It would seem that the samples should be somewhere between our office and the office of the Wisconsin Geological Survey in Madison. If they are found, they should be delivered to Madison.

The Hillpoint Cooperative Creamery states that they have seen nothing of them, and it would seem, therefore, that the shipment was lost between here and Madison.

Yours very truly,

LAYNE-NORTHWEST COMPANY

E. J. Layne

President & General Manager

ejr/lar
C.C. State Geological Survey
Attention: Miss Lillian M. Veerhusen
Madison, 6, Wisconsin

RAILWAY EXPRESS AGENCY
INCORPORATED

(680)
3-29
(Printed in U.S.A.)

UNIFORM BLANK FOR PRESENTATION OF LOSS AND DAMAGE CLAIMS

Date.....19.....
(Date Claim Presented)

.....(Claimant—Name of person by whom claim is presented) .....(Address of Claimant) .....¶ (Claimant's Number)

Railway Express Agency
(Carrier) .....(Address of Carrier) .....(Carrier's Number)

This claim for $..... is made against the Ry. Express Agcy. by the undersigned for.....
(Loss or Damage)

to.....(Article) .....shipped.....(Date) .....19..... Receipt No.....

Shipped by.....No. .....Street

From .....

Addressed to.....No. .....Street

At.....Express to.....
(If destination not an express office)

Approximate weight of shipment.....Charges were prepaid or collect?.....Amt. Chgs. $.....

Date of advice from Consignee of non-delivery, shortage or damage.....

DETAILED STATEMENT SHOWING HOW AMOUNT CLAIMED IS DETERMINED

(Number and description of articles, nature and extent of loss or damage, invoice price of articles, amount of claim, etc.)

.....:
.....:
.....:
.....:
.....:
TOTAL AMOUNT CLAIMED :

IN ADDITION TO THE INFORMATION GIVEN ABOVE, THE FOLLOWING DOCUMENTS ARE SUBMITTED IN SUPPORT OF THIS CLAIM *

( ) 1. Certified copy of the original receipt, if available.
( ) 2. Original invoice or certified copy giving description of articles by which they can be identified.
( ) 3. Other particulars obtainable in proof of loss or damage.

REMARKS:.....

.....

.....

The foregoing statement of facts is hereby certified to as correct.

.....
(Signature of Claimant)

¶ Claimant should assign to each claim, a number, inserting same in the space provided at the upper right hand corner of this form. Reference should be made thereto and also to carrier's number, in all correspondence pertaining to this claim.

* Claimant will please place check (x) before such of the documents mentioned as have been attached and explain under "Remarks" the absence of any of the documents called for in connection with this claim.

NOTE: If claim is to be settled with another party, so authorize under "Remarks."

TO CLAIMANTS: (680 3-29)

Claimants are requested to make use of this form for filing claims with Express Companies.

Claims may be filed with the carrier's agent either at the point of origin or destination of shipment, or direct with the Claim Department of the carrier, and will be considered properly presented only when the information and documents called for on the other side of this form have, as far as possible, been supplied. A duplicate copy thereof should be preserved by the claimant. It is the desire of carriers to settle promptly all valid claims, and the frank and hearty co-operation of the claimant is therefore solicited.

IMPORTANT INFORMATION TO CLAIMANTS RESPECTING LOSS AND DAMAGE CLAIMS.

Before presenting a claim on account of loss and damage, the following important information respecting claims should be given careful consideration.

1. The terms under which property is accepted and transported by a carrier are stated on the receipt issued by the carrier; also in tariffs and classifications issued or subscribed to by the carrier. Persons intending to file claims, should, before doing so, examine the terms and conditions under which property was accepted and transported. If any part of the shipment in question was subject to the Regulations for the Transportation of Explosives and Other Dangerous Articles, prescribed by the Interstate Commerce Commission, pursuant to Acts of Congress the person filing the claim should know that all these regulations applicable to the shipment had been complied with.

2. Carriers and their agents are bound by the provisions of law, and any deviation therefrom by the payment of claims before the facts and measure of legal liability are established will render them, as well as the claimant, liable to the fines and penalties by law. Attention is called to the following extract from Interstate Commerce Commission Conference Ruling No. 68.

> "It is not the proper practice for railroad companies to adjust claims immediately on presentation and without investigation. The fact that shippers may give bond to secure repayment in case, upon subsequent examination, the claims prove to have been improperly adjusted, does not justify the practice."

3. In order that the carrier may have an opportunity to inspect goods and thereby properly verify claims, any loss or damage discovered after delivery should be reported to the delivering agent, as far as possible, immediately upon discovery, or within forty-eight hours after receipt of goods by Consignee. Such notice must be given Express Agency within 15 days of date of delivery of shipment. Consignees should preserve for carrier all portions of encasings or wrappers of shipments damaged bearing names, addresses, marks, numbers, labels, etc. Where such loss or damage is not noticed until after shipment has been opened, consignee should leave shipment in the original package until a representative of the delivering company can inspect same.

4. Pending the settlement of any dispute or disagreement between the consignee and carrier as to questions of loss and damage in connection with property transported, the consignee may avoid further loss or damage, by promptly accepting the property from the carrier. Such action on his part in no way affects any valid claim which may exist against the carrier.

5. Under the provisions of the Act to Regulate Commerce, it is unlawful for a carrier to charge or demand or collect or receive, any greater or less different compensation for the transportation of property than the rates and charges named in tariffs lawfully on file, nor to refund or remit in any manner or by any device any portion of the rates and charges so specified. The refund or remission of any portion of the rates and charges so specified through the payment of fraudulent, fictitious or excessive claims for loss or damage to merchandise transported is as much a violation of the law as is direct concession or departure from the published rates and charges.

August 3, 1944

Carl H. Lindinman
Assistant to the President
Layne-Northwest Company
709 North Eleventh Street
Milwaukee, Wisconsin

Dear Mr. Lindinman:

In reply to yours of the 2nd we have no decent records in Berlin. I find that wells at the waterworks were reported as 480 to 500 feet deep, with rock at 60 feet, granite is found at bottom. Latest data: two wells, 467 and 430 feet deep. Old log of city well gives sand and clay at 60 feet, sandstone to 450 feet total depth. 150 g.p.m. flow, with pressure of 1 1/2 lbs. or 700 g.p.m. with drawdown of 20 feet. Rock at 54 feet near Irvine plant. West of river rock at 50 to 70 feet. Two blocks west of quarry drift 60 to 80 feet with no granite at 120 feet.

Park well: drift 90 feet to sandstone.

The Heald well therefore seems un reliable, as no other well shows anything like as much drift. However it may be all right. There are such deep holes in the rock in some places, but they are of very limited extent.

Very truly yours

WISCONSIN GEOLOGICAL SURVEY

by

F. T. Thwaites, Geologist
in charge of well records

FTT:js

PHONE MARQUETTE 3271

World's Largest Water Developers

LAYNE-NORTHWEST COMPANY

WATER SUPPLY CONTRACTORS

MARQUETTE BUILDING
709 NORTH ELEVENTH STREET
Milwaukee, Wisconsin

August 2, 1944

Prof. F.T.Thwaites
Wisconsin Geological Dept.
University of Wisconsin
Madison,Wisconsin

Dear Professor Thwaites:

I have been asked by a furrier in Berlin,Wisconsin, as to the depth to rock and the various formation encountered in the Southern part of Berlin, starting about a block West of the city pumping station and running approximately due East to the canning factory.

If you are not acquainted in this city, this location is on the North side of the marsh and is three or four blocks South of the main street.

In checking Page 364 of the Wisconsin Survey Bulletin #XXXV, we are wondering just how authentic the log is which is reported to have been drilled by A.R.Heald.

We have information on hand which indicates that solid sandstone was encountered at about 69' at the above location and it has also been reported that several of the city wells, which are relatively small in diameter are drilled in to the sandstone, but are reported to be wells less than 200'.

The yield from the wells in this particular part of the city is very good, as we have a pump at Carnation Milk Co., which is delivering approximately 1000 GPM, with a lift of about 65'. The well flows when not being pumped.

Do you have any information or a drillers record on this particular well which would give us a good indication as to the formations encountered when it was drilled?

Any information you can give us will be greatly appreciated as in the past.

Yours very truly,

LAYNE-NORTHWEST COMPANY

Carl H. Lindeman
Assistant to the President

chl/lar

In reply to yours of the 2nd we have no decent records in Berlin. I find that wells at the waterworks reported as were 480 to 500 ft deep when rock at 60 ft. granite is found at bottom. Latest data: two wells, 467 and 430 ft deep.

Rock at 54 ft near Irvine plant
west of river rock at 50 to 70 ft.
2 blocks west of quarry drift 60 to 80 ft when no granite at 120 ft.
Park well: drift 90 ft to sandstone

old log of city well gives sand and clay 60 ft
sandstone to 450 ft total depth. 150 g.p.m. flow
with pressure of 1½ lbs. or 700 g.p.m. with
drawdown of 20 ft

The Heald well therefore seems unreliable as no other well shows anything like as much drift. However it may be all right. There are such deep holes in the rock in some places but they are of very limited extent.

PHONE MARQUETTE 3271

World's Largest Water Developers

LAYNE-NORTHWEST COMPANY

WATER SUPPLY CONTRACTORS

MARQUETTE BUILDING
709 NORTH ELEVENTH STREET
Milwaukee, Wisconsin

August 21, 1944

Mr. F. T. Thwaites
Wisconsin Geological Survey
Madison, Wisconsin

Dear Mr. Thwaites:

NE¼SW¼ sec 32, T 22 N R 13 E

In accordance with our conversation of yesterday morning while at the Oscar Mayer Company, I checked the location of the well with reference to the Waupaca County Asylum.

This institution, with the test well and the new permanent well are located at Weyauwega, Wisconsin.

We certainly wish to take this opportunity to thank you again for your cooperation and assistance out at the Oscar Mayer Company.

With kindest personal regards, we are

Yours very truly,

LAYNE-NORTHWEST COMPANY

Geo M Galloway

Field Engineer

gmg/lar

August 11, 1945

Mr. C. H. Lindenman
Layne-Northwest Company
Marquette Building
709 North Eleventh Street
Milwaukee 3, Wisconsin

Dear Mr. Lindenman:

In reply to yours of the second, the Red Star Yeast well problem was discussed by Mr. Bean with their engineer, so this letter was let go. I am just back after a double hernia operation so not able to take care of things promptly. We have no record of the old well.

Very truly yours

WISCONSIN GEOLOGICAL SURVEY
By

F. T. Thwaites, Geologist
In Charge of Well Records

FTT CMA

LAYNE-NORTHWEST COMPANY

WELL WATER SUPPLY CONTRACTORS
LAYNE DEEP WELL TURBINE PUMPS

AFFILIATED WITH
LAYNE & BOWLER, INCORPORATED

MARQUETTE BUILDING
709 NORTH ELEVENTH STREET
MILWAUKEE 3, WIS.

PUMP & WELL
EQUIPMENT FOR
MUNICIPALITIES
INDUSTRIES
RAILROADS
MINES & IRRIGATION

FACTORIES
MEMPHIS, TENN.
HOUSTON, TEXAS
LOS ANGELES, CAL.

August 2, 1945

University of Wisconsin
Geological Department
Madison, Wisconsin

Attention: Mr. F. T. Thwaites;

Gentlemen:

We are wondering if you have any record of the well which was drilled some years ago for the Red Star Yeast Co. at 325 N. 27th St., Milwaukee, Wisconsin.

We would appreciate any information you may have as to the size of the casing and the depth to rock, and the total depth of the well.

Thanking you in advance for an early reply by return mail, we are

Yours very truly,

LAYNE-NORTHWEST COMPANY

S. H. Lindenman

Assistant to the President

chl/lar

In reply to yours of the 2nd The Red Star Yeast well problem was discussed by Mr. Bean with their engineer. so this letter was let go. I am just back after a double hernia operation so not able to take care of things promptly.

We have no record of their old well

LAYNE-NORTHWEST COMPANY

WELL WATER SUPPLY CONTRACTORS
LAYNE DEEP WELL TURBINE PUMPS

PUMP & WELL
EQUIPMENT FOR
MUNICIPALITIES
INDUSTRIES
RAILROADS
MINES & IRRIGATION

AFFILIATED WITH
LAYNE & BOWLER, INCORPORATED

MARQUETTE BUILDING
709 NORTH ELEVENTH STREET
MILWAUKEE 3, WIS.

FACTORIES
MEMPHIS, TENN.
HOUSTON, TEXAS
LOS ANGELES, CAL.

August 28, 1945

Mr.F.T.Thwaites
U.S.Geological Survey
Science Hall
University of Wisconsin
Madison, Wisconsin

Dear Mr.Thwaites:

I learned after writing you, that you had gone to the hospital for an operation, but did not know that you had to go through as serious an operation as a double hernia.

From your letter I see that you are back, and I hope and trust you are feeling much better and will continue to do so.

You have always been so kind in acknowledging our letters and doing work for us, and we certainly want you to know that we appreciate it very much.

Best regards.

Yours very truly,

Carl H. Lindenman

C.H.Lindenman
Layne-Northwest Co.
Assistant to the President

ch l/lar

February 18,1947

Mr. A.C.Roberts
Western Condensing Co.
Appleton,Wisconsin

Dear Mr. Roberts:

We note by your letter of February 14 that Mr. Beam has written you stating that he has not received the samples from the first Mishicot well.

This seems quite strange to us inasmuch as I recall Mr.Crews' arranging that the sample be taken and from our records here the samples were sent in from your Mishicot plant.

Will you be so kind as to ascertain by writing the plant if they can recall when the samples went forward to the University of Wisconsin, Well Division. We have no samples here at the office or at the warehouse, consequently, we feel quite sure that they were sent or it may be that they are still at your Mishicot plant.

Yours very truly,

LAYNE-NORTHWEST COMPANY

C. V. Lindenmayer
Assistant to the President

chl/lar

C.C.Mr.E.F.Bean,
State Geologist
University of Wisconsin
Madison,Wisconsin

January 6, 1947

Mr. C. H. Lindenman
Assistant to the President
Layne-Northwest Company
Marquette Building
709 North Eleventh Street
Milwaukee 3, Wisconsin

Dear Mr. Lindenman:

In reply to yours of December 28, I am enclosing a blueprint log of the Sunrise Well (City No.4), at Sturgeon Bay, Wisconsin. It has been reported that this well showed contamination. It may be that the loss of head is due to underground leaks above the artesian water. The samples did not show anything important at the bottom.

Very truly yours

WISCONSIN GEOLOGICAL SURVEY
By

F. T. Thwaites, Geologist
In Charge of Well Records

FTT HPP
Enc. 1

March 31, 1947

Mr. C. J. Ogran, Vice-President
Layne-Northwest Company
Marquette Building
709 North Eleventh Street
Milwaukee 3, Wisconsin

Dear Mr. Ogran:

Your letter of March 18th regarding a ground water survey at Medford is much appreciated. I am not at all confident that a geologist will be able to furnish useful advice. My schedule is so filled at present that there is no chance of getting up there before April 21st or 24th.

Very truly yours

WISCONSIN GEOLOGICAL SURVEY
By

State Geologist

EFB CFP

March 18, 1947

Mr. B.F. Way
Medford, Wisconsin

Mr. Martin Fishman
Medford, Wisconsin

Gentlemen:

While at Medford last week, discussing the test drilling operations and locations with Mr. Fishman and Mr. Way, I made the suggestion to Mr. Way that it might be advisable to ask Professor E.F. Bean, State Geologist at Madison, Wisconsin, to make a study of the water tables around Medford and make recommendations as to a desirable location to drill in search of an adequate water supply for the City of Medford.

This suggestion was made by the writer because of his confidence in Professor Bean's ability, and I might say nation-wide reputation as a geologist.

I am quite sure if you could prevail on Professor Bean to come to Medford and study your water problems, he could give you some very valuable advice, make some worthwhile recommendations.

Professor Bean can be reached by letter at - University of Wisconsin, Science Hall, Madison, 6, Wisconsin.

Yours very truly,

LAYNE-NORTHWEST COMPANY

Vice-President & Field Mgr.

cjo/lar

C.C. Professor E.F. Bean
University of Wisconsin
Science Hall
Madison, 6, Wisconsin

FACTORIES
MEMPHIS, TENN.
HOUSTON, TEXAS
LOS ANGELES, CAL.

WELLS AND PUMPS FOR
MUNICIPALITIES
INDUSTRIES
MINES AND RAILROADS

Layne-Northwest Company

AFFILIATED WITH
LAYNE & BOWLER INC.

MARQUETTE BUILDING
709 NORTH ELEVENTH STREET
MILWAUKEE 3, WISCONSIN

MARQUETTE 3271

WELL WATER SUPPLY CONTRACTORS — LAYNE DEEP WELL TURBINE PUMPS

March 18, 1947

Professor E.F.Bean,
State Geologist
University of Wisconsin
Madison, Wisconsin

Dear Professor Bean:

We of the Layne Northwest Co. have been doing considerable exploratory work in and around the City of Medford, Wisconsin, in search of formations which would yield a satisfactory water supply for that city.

To date, after drilling 15 test holes, we have only located two test holes which in our opinion would possibly yield 100 GPM. This supply, of course, would help out if nothing better is available, however, if we could obtain a supply of 400 or 500 GPM, I am sure you can appreciate what it would mean to the City of Medford.

We have one or two more locations which we believe offer some possibility, but at the same time we would like to keep down the cost of this exploratory work to a minimum. With this thought in mind I have discussed the possibility with Mr. B.F. Way at Medford, who is on the Water Commission, suggesting they contact you and see if you would go to Medford and make a study of their problem and make recommendations as to possible locations for water supply.

A copy of my letter to them is herewith enclosed.

Yours very truly,

C.J.Ogran
Vice-President & Field Mgr.
Layne-Northwest Company

cjo/lar

Layne N. 1

March 21, 1946

Layne-Northwest Co.
709 N. 11th St.
Milwaukee 3, Wisconsin

Attention: Mr. Galloway

Dear Mr. Galloway:

Some time ago we received a nail keg full of well samples which was sent by you. A tag stated that they were from Jefferson but some are marked Carnation Milk Co., Berlin. They seem to be samples from two wells mixed. Is it possible for you to enlighten us as to which is which?

We never got any samples from Columbus.

Very truly yours

WISCONSIN GEOLOGICAL SURVEY
By

F. T. Thwaites, Geologist
In Charge of Well Records

FTT HPP

Gen'l.
Layne-N. W

115 Science Hall
Madison 6, Wisconsin
December 3, 1947

Received of CLYDE WILCOX, Driller for Layne-Northwest, samples from Mendota Hospital Well, surface to 793 feet.

WISCONSIN GEOLOGICAL SURVEY

State Geologist

December 29, 1947

Layne-Northwest Company
709 N. 11th Street
Milwaukee 3, Wisconsin

Gentlemen:

Attention: Mr. Galloway

Logs of wells at Mishicot and Brosen Manor are ready to print but we have no information on casing, size of hole, and results of test, if any. Could you please let us know so we can clean up our files?

Very truly yours,

WISCONSIN GEOLOGICAL SURVEY

F. T. Thwaites, Geologist
In Charge of Well Records

FTTbsc

borders. I have never seen the area in question. Hope to get out there some time. I am always decidedly skeptical about so-called constructional forms which are not associated with undrained areas inasmuch as certain types of erosion topography very much simulate glacial topography. We have had a number of mistakes in this state due to confusion of erosion forms with terminal moraines so that I am afraid I am not properly impressed by some of these reports.

With regard to the early publications of descriptions of buried soils, etc., I was confining my attention to those instances where the word, interglacial, had been used. Of course I knew of a great many mentions of the phenomena at very early dates but did not desire to spend any time on summarizing them but only the publications where some discussion of the significance was given.

I wish to thank you very much for the references to early material which I will proceed to work up. I will take the matter up with Mr. Alden to see what he can suggest about this manuscript but can undoubtedly shorten it considerably. It is, however, too long in any event for publication in most places. Thanking you again for your kindness, I am

Yours very truly,

FTT-M

Geologist

March 24, 1924.

Mr. Frank Leverett,
United States Geological Survey,
Ann Arbor, Michigan.

Dear Mr. Leverett:

I wish to thank you very much for your letter of the 19th and I appreciated your criticisms very much indeed. I do not, however, see very much in some of the articles to which you take exception. I thought that I had condemned Upham in about as scathing terms as one would dare. On the other hand I think that some of Wright's early criticisms were justified, but his failure to advance any further in so many years is very much against him.

In regard to Bain's paper I will re-read the same and see if I made any slip. I think I based my write-up on some old notes and not on a re-reading.

In the matter of Hershey's papers he was so far astray on his peneplains, etc. that I have never given his other work much consideration. I will, however, read some of the articles.

In regard to Alden's paper on northern Illinois, my understanding of the situation is that the post-Illinois drift of Leighton does not in any way, shape, or manner correspond to the Iowan drift of Monograph 38 which showed a border west of Rock River. I have been over some of Leighton's areas in the field and have found some evidences which seemed to go against his interpretation. I expect to see more of the district in May and will then be able to judge better.

So far as I could find, Bain and Wilder were the first to state explicitly that depth of residual material is related to weathering. I can see, however, that you had the same idea much earlier, but the point was not explained in detail.

With regard to Carman's paper I am still inclined to hold to my view inasmuch as he was not stampeded to discriminate drifts which had no definite vertical or horizontal

Refer to Mr Thwaites

June 1,1938

Dr. Frank Leverett
1724 South University Avenue
Ann Arbor, Michigan

Dear Doctor Leverett:

I am enclosing a preliminary blueprint of one of the illustrations for my report on Northeastern Wisconsin. Will be very glad to have any suggestions or corrections that you can make. I departed from your maps in showing Weidman's Third Drift as doubtful Wisconsin. I have found that the Third Drift in Barron County is Wisconsin, as it shows distinct constructional features and a youthful soil profile. It has not been possible for me to check whether or not this applies to all of what he mapped as Third Drift. My large map check showed that it was probably Illinoian, following your interpretations of a few years ago.

Very truly yours

WISCONSIN GEOLOGICAL SURVEY
By

F. T. Thwaites, Geologist
Well Records

FTT LMV

enc.

Ann Arbor Mich July 14 1930

Dear Dr Bean:

I am inclosing a carbon copy of a letter to Mr. Alden which pertains to interpretations he reports Mr Hansen to have made and which I am criticising. It seems important to look into these matters for ourself before anything is published.

Very truly yours,

Frank Leverett

(Carbon copy)

Ann Arbor, Michigan, July 14 1930.

Dear Dr. Alden:

Your letter from Missoula, Montana, was received this morning, and I am much obliged to you for giving so full an account of your trip in Wisconsin. Some of the results, however, seem to be open to question, and I am sending a carbon copy of this letter to Dr. Bean, to guard him against the publication of certain conclusions reached by your party.

You seem not to have seen exposures near Grantsburg that sustain Dr. Berkeys interpretation that till is present above the laminated clay which he described in his paper in the Journal of Geology in 1905. I visited this locality with Dr. Weidman in October 1910, and I will give you a copy of my notes;

Notes by Frank Leverett October 28 1910. "In Grantsburg is a brickyard in the bank of Wood River, in the west part of the village, that uses a laminated clay in which occasional boulders are imbedded, but which has scarcely any pebbles. It is exposed 20 - 25 feet deep. It was this clay which Berkey discussed in the Journal of Geology, and used as a chronometer. It has bands of light and dark color, that taken in pairs he thinks represent the deposition in a single year in a lake, which he assumed was fed by sediments from an ice border to the north.

The top of the clay is eroded, and on it is a very old looking blue-black till, full of limestone pebbles, and also pieces of chalky rock of Cretaceous (?) age. This till is only a thin remnant 4 - 6 feet thick. Above it is reddish sandy gravel. The till has dark rusty iron seams, and ferruginous tubes, and is very hard and caky like the Kansan drift. Probably it is Kansan, while the clay of that age or still older. Berkey did not have this idea, but put the clay as well as the overlying till in the Wisconsin stage. Probably he is correct in assuming the pairs of bands to represent annual deposition, though of that I am not certain".

Another point I am inclined to question is the presence of a beach as high as 1160 feet on the south side of Lake Duluth near Pattison State Park. According to my notes the gravel plain bordering the upper St Croix Lake is only 1140 feet, and this may have been trenched somewhat by the drainage from the ice before any ponding had occurred in the Brule valley. It is likely to have been still further trenched by the outflow from Brule Lake before the Lake Duluth waters found discharge down the St. Croix valley. On the bluff back of Duluth I found faint traces of a shore at about 1160 feet but the highest well defined shore there is about 1135 feet. As this region has suffered considerable northward differential uplift the shore lines at Duluth are distinctly higher than in Douglas County, Wisconsin.

If these matters go uncorrected by Mr. Hansen I fear the effect of his paper will be to ball matters up.

I probably will be in Ann Arbor for the next two months, but later I may be travelling in the South, along the Gulf Coast between Florida and Texas. It would be gratifying, therefore, if the proof of my Minnesota report can be ready to read before I leave Ann Arbor.

Very truly yours,

Frank Leverett

Ann Arbor,Mich.January 11,1930.

Mr.E.F.Bean,
State Geologist,
Madison,Wis.

Dear Mr.Bean:-

As you have received the letters by Martin and Director Smith in reference to a passage in my recent report,Prof.Paper 154 A,that gave Martin offence,you no doubt will be interested in my statement made to Martin in reply to his criticism. You will also be interested in learning what changes seem to me necessary in the Physical Geography of Wisconsin if it is reprinted. If you think best you may turn my letter over to Dr. Leith to read. The study by Van Hise and Leith forming the basis oftheir monograph is strikingly different from that of Martin,and I think Leith will so consider it.

With best wishes for the New Year,I remain,

Very truly yours,

Frank Leverett

(Copy)

Ann Arbor, Mich. January 10 1930.

Dear Dr. Martin:-

I am in receipt of a copy of your letter of Dec. 23, 1929 to the Director of the U.S. Geol. Survey, and of his reply, dated Jan. 7 1930. The Director made no suggestions as to whether or not I should write you. I am now retired from the Survey, because of the age limit, so I presume he feels that I am no longer under his direction. I am interested, however, in making a statement to you, and will send him a copy of this letter.

I notice the Director has covered the matter of the lack of due credit to the University of Wisconsin for the relief model used as Pl. 3 of my report, 154 A. This oversight I think should be charged to the Division of Illustrations. I certainly had no thought of claiming credit for its production.

In regard to your report on the Physical Geography of Wisconsin, I did not intend to give the impression that it was prepared on as slender a basis of field work as your chapters in Monograph 52, for I realize that it represents a lot of study on your part. I consider it a very creditable piece of work, but it includes some illustrations from Monograph 52 that seem faulty. If it is reprinted I would suggest omitting Fig. 179, as it does not show the present state of knowledge of ice-movements so well as Fig. 80 does. I think Fig. 180 should be made to harmonize with Fig. 8 of my 154 A. Also, that your Fig. 184, which is credited to me, should be supplanted by my Fig. 8. Your Fig. 65 of Monograph 52, which is reproduced as Fig. 181 of your Physical Geography, seems to have no real basis, so might as well be dropped. As indicated in my report, on p. 10, there seems to be clear evidence that suhh piracy by St. Louis River as you picture in Fig. 9 of Monograph 52, and reproduce as Fig. 176 in the Physical Geography, has no real basis, so should be dropped. Your Figs, 60 and 62 of Monograph 52, as you will see by comparison with my glacial map, Pl. I of 154 A, are far from correct. The ice crossed the "Giants Range" from the north and brought Keewatin drift into the St. Louis drainage basin, not only in the late Wisconsin stage, but also in the Kansan. What you call a lake clay near Mountain Iron is instead a clayey till.

I think I appreciate the creditable work that you have done in Alaska, New York and Wisconsin, and your abilities as a writer. But I regard the writing of the Pleistocene for the Van Hise-Leith monograph as a less creditable production. I fail to see where you advanced the knowledge of the region in any way. The three months you gave to field work there embraced little or no mapping of the sort that I have done, or of the sort that Van Hise and Leith had done there on the rock formations. I regard your work there about as I would expect you or Coleman to regard three months spent by me in the district surrounding Lake Ontario, a district new to me, as a basis for writing a report on the Pleistocene of that district. I fancy you would be inclined to ridicule my effort to write a report on so hurried a study. I would have to cull most of my descriptions from old reports. While, therefore, I might have worded my statement on p. 5 of 154 A in a way that would have caused you less offence, it would not have altered the facts in the case.

Very truly yours,

Frank Leverett

February 4, 1927.

Mr. Frank Leverett,
1015 Lowell Avenue,
Tucson, Arizona.

Dear Mr. Leverett:

I wish to thank you for your letter of February 1. I will alter the statement in accordance with this discovery. I have been unable to get any criticisms at all from Dr. Kay, so I am unaware of what his later discoveries were. I visited the Aftonian in 1924 and from the exposures which I saw I would not attach any importance at all to the Aftonian gravels.

I also visited the original locality of the Buchanan at that time. I do not agree with you about the till overlying the gravels. I examined several cuts very carefully and found that the difference in color is what we normally find toward the top of a weathered gravel deposit where the surface has been marshy at some time in the past. It is true there are some bowlders near the surface of the gravels, but the occurrence of bowlders in outwash gravels of this type is so common in Wisconsin that we would not give such an exposure a second look as far as any significance would be attached to its bearing on interglacial conditions.

I think the applying of stratigraphic names as has been pointed out is a fundamental error which must be got rid of very shortly. By this I do not mean the naming of a drift or an interval but the naming of a gravel bed or clay bed and the attempt to correlate other gravel and clay beds with the original.

Thanking you again for your criticisms, I am

Yours very truly,

FTT-M

Geologist

1015 Lowell Ave.
Tucson, Arizona February 1 7

Dear Mr Thwaites:

I did not speak of the Aftonian in my letter of January 29, so am writing to tell you that in June 1925 I visited Afton Jct. with Kay and we found excellent exposures of gumbotil there in a gravel pit south of the E-W RR and west of the N-S one at top of the Nebraskan till. We also saw the same gumbotil in a new highway grading within ½ mile N2 of this railroad crossing. The occurrence of the gumbotil here at the type locality of the Aftonian gives in our opinion a good basis for holding the name Aftonian. So your suggestion as to dropping the name mark on p 67 of your outline loses its pertinence.

Very truly yours,
Frank Leverett

February 2, 1927.

Mr. Frank Leverett,
1015 Lowell Avenue,
Tucson, Arizona.

Dear Mr. Leverett:

I wish to thank you very much for yours of January 29. I will take note of the suggestions very carefully. I note that in some cases I have misinterpreted your statement. With reference to the elimination of the Iowa in your paper of 1909 the impression which I stated was obtained from a paper by Miss Oglevie, namely that it was the result of studies in Europe which led in the direction of a system of four drifts only. However, if this was incorrect I will see that the correction is made.

With regard to the trend toward two glaciations in Europe I noted that Dr. Berkey in his papers on Mongolia gives that interpretation and that Dr. Hrdlicka who was here about two years ago also presents this idea. I have not searched the European literature but find that recent studies in Norway are reported to state that there was only one complete deglaciation.

With regard to the use of erosion as a time measure I think my criticisms are justified. The enormous amount of erosion of the red clays around Superior is a case in point. Furthermore the amount of erosion in hilly districts is quite different from that in flat plains. The only point which I wish to raise is that there can be no flat relation between the amount of erosion and time, but that the factors have to cancel out.

With regard to the relative importance of the different glacial centers, I have quite changed my attitude; in fact the new glacial outline will be recognized as the product of the same author only with considerable difficulty.

I spent four months last summer in northeastern Wisconsin where I found a number of interesting things, some of which reduce my confidence in the usual criteria. I did not get the moraine of the red drift to cross Shawano County just where it does on your map although it is only a few miles away. West of this moraine I found some red clays which are not laminated but which overlie

pitted outwash. These still puzzle me although I think they represent a period of blocking of the drainage and formation of temporary lakes. Even east of the red moraine I found some difficulty in discriminating between lake deposits and ground moraine. I hope to carry these studies further the coming season and will probably solve the difficulties then.

I wish to thank you again for your kind letter. I trust the trip to Arizona will benefit your health.

Yours very truly,

FTT-M

Geologist

1015 Lowell Ave Tucson Arizona until April 15 1927

Tucson Arizona January 29 1927

Dear Mr Thwaites:

Your letter of Jan 22, was forwarded here here, where I am spending the winter months, with the hopes of getting rid of a troublesome bronchial cough.

I have gone through your 1925 Outline of glacial geology today and find most of it is in accord with my own understanding. But there are a number of mis-statements that I think you should correct in the outline you are now preparing. Thus on pages 10 & 11 there seem to be fewer present streams in preglacial courses in the glaciated districts than your statements imply. It is an exceptional case when present drainage follows the preglacial course for any considerable part of its length. On pp 24-25 you fail to show that rock formations are often sculptured into drumlin forms Fairchild calls such forms "Rocdrumlins" Taylor says some of the best drumlins in the Finger Lakes region have turned out to be rock basis, that were supposed to be drift. I have found them in the Grand Traverse region in Michigan

The statement on p 72 as to marginal moraine of Illinoian drift is faulty. There is a good moraine in Southeastern Iowa, and in Hancock, Adams Pike, Jersey Monroe St Clair and Randolph counties, Illinois. The statement on p 73 in regard to the third drift of NW Iowa should be corrected & now that this drift has a definite border with stretches of moraine of considerable length for

a distance of 200 miles in NW Iowa, SW Minnesota and eastern South Dakota (See my paper in Proc. Am. Phil. Society 1926)

There is no doubt, such as you express on p 73, of the course of the Mississippi across southeastern Iowa in the Illinoian stage. There is a definite erosion channel there, recognized as such by residents, as well as by geologists.

The type locality of Buchanan gravel at the Doris pit near Independence Iowa shows several feet of till over the gravel. So your statement on p 77 is wrong. The statement on p 78 that no valleys in the Iowan drift area have been blocked by that drift is contrary to fact. There on several places in the Minnesota part where the diversion has been sufficient to throw the stream across bordering rock points. There are also many places where kames of Iowan age lie in valleys that had been cut in the Kansan drift and partially obstruct them, those near Zumbrota, Minn. are conspicuous examples.

The statement on p 79 that there are no definite constructional features on the Third drift of NW Iowa is contrary to fact. There are kames as well as moraines in Iowa as well as in Minnesota and South Dakota.

I think you are incorrect in stating on p 93 that European glacialists are tending toward a belief in but two glacial stages. I have tried to keep up on the European glacial literature and have never seen anything suggesting such tendency.

You may be interested in knowing that W B Wright whom you quote on p 93

wrote me after receiving my paper in Proc. Am Phil. Society that he had studied the maps there referred to and was greatly impressed with their significance in showing wide differences in the age of Kansan Illinoian and Wisconsin drifts, and that he will endeavor in case a new edition of his book is published, to make due correction of the statements in the first edition that cast doubt on the strength of the evidence.

This leads me to say in conclusion, that you appear to be decidedly on the wrong track when you attempt to correlate Kansan and Illinoian drifts, and reduce the glacial epoch to two glacial and one interglacial stage. Your discussion of erosion on pp 55–56 muddles matters badly. I feel certain that the time element is responsible for more than 90% of the difference displayed by Kansan, Illinoian, and Wisconsin drifts and qualifying conditions such as you bring in balance one another to some extent and in no way throw doubt on the correctness of the interpretation that these drifts differ widely in age. The Kansan drift shows clear evidence of an erosion that would require about 50 feet of material to replace. While the Illinoian shows scarcely 1/3 as much. I think the maps of Illinoian bear me out in saying that the erosion would only require about 15 ft to replace in the western Illinois district. To the east of the Kaskaskia I would estimate it at only 10–12 ft. This applies eastward to southwestern Ohio, and stands for what I

clays as Middle Illinoian in my paper in Proc. Am. Phil. Society. It is more difficult to make an estimate on the Jowan (which I regard as Late Illinoian) but I think no more than 10 feet of average erosion is required to give the pebble concentrate displayed on its slopes. The Wisconsin drift has had so little erosion that 5 feet seems a liberal estimate of the amount of material required to fill its valleys. There may be 5 feet needed in the early Wisconsin but the late Wisconsin seems to demand no more than 2 or 3 feet.

It also seems to me unfortunate for you to teach a class of students that the erosion of drifts is an uncertain test of age in the way your outline implies.

You put me in a false light on pp 62 and 77 when you state that it was my studies in Europe that led me to try to cut out one glacial stage. Those studies had nothing to do with my views concerning the Jowan drift they were determined by field studies and has shifted from time to time in accordance with the growing acquaintance with its features. I now think there is an Jowan drift, standing as the third drift from the Keewatin district

On p 70 you state that all the recognized Kansan drift came from the Keewatin center. But the evidence is clear that a pre Illinoian ice movement carried copper from the Lake

Superior region into Ohio and N W Pennsylvania — Such a movement is entirely out of harmony with the Illinoian as well as with the Wisconsin movement. It also seems out of harmony with the first or Jerseyan ice movement for that like the Illinoian and Wisconsin took a S W course from the Labrador peninsula into Illinois and even reached southeastern Missouri. I saw exposures of old drift in the Kaw valley that has the Kansan characteristics a calcy joint clay, and I am tentatively referring it to that stage.

On p 64 you indicate that there is no exposures of Nebraskan drift outside the Kansan. You may not have learned that patches of deeply weathered till, and deeply weathered bowlders has been found by W.H. Schoewe outside the Kansan drift in N E Kansas that seem to me as well as to him to be Nebraskan. Further west there was pooling in the Nebraskan stage that affected the extension of the ice in Nebraskan time, but small divorce outliers from the Minnesota or South Dakota outcrops have been seen by me beyond Salina Kansas. Dr Schoewe is now carrying on studies that aim to show the effect of the Nebraskan glaciation in that State —

Very truly yours

Frank Leverett.

L.

January 19, 1926.

Mr. Frank Leverett,
U. S. Geological Survey,
Ann Arbor, Michigan.

Dear Mr. Leverett:

I wish to thank you for your letter of the 14th and for the copy of the Cam/Custer quadrangle. I think, however that I will not change my illustrations although some portions of this are certainly excellent.

I have never had an opportunity of seeing the moraine which is found south of Sharon, Wisconsin but hope to be able to do so in the spring. I expect to go to the Unitersity of Illinois next week and will then have an opportunity to talk over some of these matters with Mr. Leighton. I also hope to be in Iowa for a time in spring.

Yours very truly,

FTT-M

Geologist

Ann Arbor, Mich. January 14 1926.

Dear Mr. Thwaites:-

Your letters of Jan. 8 and 9 have been received, and I am glad to have your criticism of Buell's views. I read a considerable part of Buell's letter to Prof. T.C. Chamberlin when in Chicago on my way to Kansas City, and he says Buell is wrong in the extension of a Green Bay movement beyond the Wisconsin terminal moraine. At Beloit he has noted Devonian material from near Milwaukee, and the striae there point directly westward.

I am interested in what you say concerning the mapping of pitted plain as moraine by Alden. The typical pitted plain should be easily distinguished from moraine, as it does not carry bowlders, and is made of material more or less distinctly assorted. I have found places, however, where the icesheet readvanced over an outwash plain and dropped bowlders on it, without leaving much till, or greatly modifying the topography. In some such cases it is difficult to know how to class the drift.

The Battle Lake, Minn. topographic map, and the Perham, north of it, are excellent ones to use to illustrate pitted plains with very large pits. The Camp Custer Michigan map is also. Gull Lake occupies the largest of the pits. This map is also a good one to show how much alike the pitted outwash and the moraines appear in a map, and that too when they are in striking contrast, and easily distinguished in the field. I think I will send you a copy of this map with the boundary lines of moraines, outwash, till plains, and glacial drainage drawn in pencil, that you may see how little contrast there is in topography. The outwash here is of the typical sort, free from bowlders, and built up to a definite plain between basins. The moraines are of till, and thickly strewn with bowlders, and they do not have a plain surface between the basins, but the surface is full of slight irregularities of contour that the 20-foot contour does not bring out. Probably a 10 foot contour would show them. The very numerous basins in the moraine here give it the appearance of a pitted plain, as they stand out better than the knolls among them. By using the text figure on the back of the map as a guide you will probably have no trouble in interpreting my boundary lines, but without it I doubt if you would find it easy. I refer to Fig. 3.

My report on Minnesota is not yet in shape to turn in for publication, but I hope to complete it by the close of this fiscal year. Then it will probably be two or three years coming through the mill, so I am expecting to be on the retired list before it is published.

I hope you will have opportunity to see whether the definite moraine which comes up to Sharon, Wis. from the south has a definite northward continuation from that village, and if so, with what moraine in Wisconsin it correlates, or whether it is instead overridden by the moraines on the border of the Delavan, or the Green Bay Lobe. The Harvard topographic sheet, of which I have a photolith, shows it clearly in the east part of Leroy Tp. Boone Co. Ill. I suspect it is the Bloomington moraine, and that the moraine running south from Belvidere, Ills. is also the Bloomington. I do not accept Leighton's outline of the Belvidere Lobe. I have tried to get him interested in testing out my views, but he is too busy with official duties to do much field work.

Very truly yours,

Frank Leverett

January 9, 1926.

Mr. Frank Leverett,
U. S. Geological Survey,
Ann Arbor, Michigan.

Dear Mr. Leverett:

Your letter of December 22 has been given very careful consideration together with the copy of the letter from Mr. Buell.

There is one aspect of the problem which has not been mentioned by any geologist, that is the boundary line between the Illinois and Wisconsin approximates the contact between the gravelly tills with attendant kames which are so abundant west of the Niagara escarpment in Wisconsin and the clay tills of the Lake Michigan lobe in Illinois and east of the Niagara escarpment in Wisconsin. The appearance of kame moraines is so strikingly different from that of till moraines, particularly of clay till, that it is small wonder confusion has arisen. I fail to see why Mr. Buell concludes that you and Alden are "a continent apart" in interpretation. It has always appeared to us that Alden's mapping was if anything warped to fit Monograph 38. The weakest part of his mapping consists in the failure to recognize pitted outwash as distinct from terminal moraines. The road material surveys have shown very clearly that the area east of Lake Geneva mapped by Alden as terminal moraine is wholly pitted outwash as far east as Fox River. The great Elkhorn plateau which Buell makes so much of appears to us to be overriden pitted outwash apparently covered by a re-advance of the ice before all the ice blocks had melted. The interbedding of gravels and tills in the Lake Geneva district is very clear proof of oscillations of the ice margin. Granting such oscillations with the subsequent over-riding of outwash gravels making very gravelly tills and hence many kames is I think an important thing to be recognized.

I fail entirely to see why Mr. Buell makes so much of ice outflow from Milwaukee. As a matter of fact structure studies show that there is no pronounced syncline at that point. The Devonian is unconformable on the Silurian which happens to be rather thin north of Milwaukee. I admit, however, the possibility of the Troy Valley having drained to the east into the Lake Michigan basin rather than in the direction suggested by Alden. A few days ago I heard of a well record near Milwaukee

where the shale was found below the drift. This may represent the eastward extension of the Troy Valley.

I fail to see why Buell thinks there was a change of altitude of 200 feet at interglacial time. At least he does not state any evidence of such.

I also object to his statement that the Iowan drift is well established in geological literature. I do not think we ought to treat anything as well established and go out and expect to find it, but believe that the problem should be approached from an entirely unbiased standpoint. I also object very seriously to the statement that the drumlins outside the terminal moraine are a deposit of a larger Green Bay lobe. Their material and orientation both make them Lake Michigan without serious doubt. It is one of the puzzling features of Wisconsin Pleistocene geology that the enormous extent of older drift in Illinois was not matched by a large pre-Wisconsin Green Bay lobe. It would appear that the Green Bay lobe is mainly a feature of the Wisconsin drift, possibly because of interglacial erosion along the Green Bay shale belt.

A study of the new topographic sheets in the office has suggested to me that there is a series of moraines which run from the Darien Moraine in Wisconsin diagonally across the Marengo Ridge terminal moraine to join the Valparaiso System farther south. I think there can no longer be any question but that Alden's mapping much exaggerates the importance of the Delavan lobe. It would be entirely unreasonable to suppose that the Green Bay lobe reached such large development without a large Illinois lobe. Some have sought to explain these peculiarities by assuming local accumulation of snow, but the Driftless Area shows definitely that there was no glacial accumulation at low altitudes in this latitude. I, therefore, regard the mapping of the late Wisconsin border by Alden as decidedly improbable and think that the angle in McHenry County, Illinois was undoubtedly filled with ice. Whether or not the Delavan lobe appeared as a distinct lobe during ice recession as mapped by Alden I am not prepared to say, but I do know that some of his supposed moraines are merely remnants of pitted outwash plains which were later dissected by glacial waters and that others are areas of till which was spread as ground moraine over buried ice blocks. I believe that a restudy of the area would add many interesting results, but that to make a new study we must forget all about previous conceptions and approach the area on its own merits.

Yours very truly,

FTT-M

Geologist

DEPARTMENT OF THE INTERIOR

UNITED STATES GEOLOGICAL SURVEY

Ann Arbor Mich Dec 22 1925.

Dear Mr Bean:

I am inclosing a copy of a letter received yesterday from Mr Buell, in which I am sure you will be interested, and so will Mr Thwaites, so please turn them & him back. I inclose also my reply.

I shall be interested to learn more as to the gravity porphyry distribution and also as to the physical drainage. Probably each of you can note on the matter.

I am giving to read the letter and my reply to Mr Alden also.

I am wondering if you will not be present at the Kansas City meeting of A.A.A.S. in which case we can talk over these questions. I am planning to discuss the status of the Iowan drift problem there.

With best wishes for the Holidays and New Year

Very truly yours,

Frank Leverett.

GOVERNMENT PRINTING OFFICE

(Carbon copy)

Ann Arbor, Michigan, December 22, 1925.

Dear Mr. Buell:-

Your letter of December 3, mailed Dec. 16, reached me yesterday, and I have read it with much interest. The summary you present brings back to me much of my early work in the field you discuss, in northern Illinois and southern Wisconsin. I feel as you do that the last word has not been said concerning this field, and I hope to live long enough to see some of the conflicting interpretations cleared up. Perhaps it will stimulate further work if I should pass your summary on, with my own comments, to the State geologists of Wisconsin and Illinois, and also to Prof. Chamberlin and Mr. Alden. Probably most of the work from now on will be done by these State surveys.

I am wondering if you have seen the Harvard and Genoa, Illinois, topographic maps. I have received the photoliths a few months since, but presume the engraved sheets have not yet been issued. They cover the place where the Bloomington morainic system comes in from the west about to the Marengo Ridge, and show that ridge and the district to the west. From a study of these new maps I have been led to wonder if the Bloomington morainic system does not make an abrupt northward turn near Genoa and run north into Wisconsin outside (west of) the Marengo Ridge, instead of being overridden by ~~as~~ the Marengo Ridge. I have passed this suggestion on to Leighton, the State Geologist of Illinois, and to Mr. Alden, and I think Leighton will test the matter out . The moraines south of Belvidere fall in this ~~xxxxxxxx~~ suggested continuation of the Bloomington system, and also the morainic belt that runs northward from Capron to Sharon near the line of Boone and McHenry counties. Leighton has done some work in that region, and published results in the Bulletin Geol. Soc. America, and in the Journal of Geology, as you probably are aware. The suggestion I have made as to the Bloomington age of these moraines is different from Leighton's view as published, for he regards them as of Shelbyville age. He also makes the morainic belts south of Belvidere run at a right angle to his conception of the trend of the ice border, and tries to consider them as something else than terminal moraines. In this I think he is doing violence to the subject in order to carry a point. I hope, therefore, that my suggestion will be tested out, as it seems to give these morainic ridges a natural place along the ice border.

I think a considerable part of what I mapped as Iowan in Mon. 38 is likely to be Early Wisconsin. This may be the case in the Green River basin , as well as in northern Illinois. I think Leighton is inclined to support that view, thogh his last letter to me on the subject expressed some uncertainty as to how to interpret that district. This meets the inquiry in the last sentence of your letter.

I am much interested in what you state as to the distribution of the quartz porphyry bowlders from the Lake Superior region, and to learn that C. C. Douglass traced the course of their dispersion so long ago. I should think the Wisconsin Geol. Survey might now have considerable additional data concerning this dispersion.

With best wishes for the Holiday season and the New Year,

Very truly yours,

Frank Leverett

Copy.

Pasadena,Cal.December 3 1925.

Dear Friend:-

Several incidents have led me to reopen correspondence with yuu after a long interval. From a student with whom I visited on his way to New Orleans,last summer,I had fresh knowledge of your work in the Univ. of Michigan. My visit to southern Wisconsin,in August,brought me over much of the ground that we formerly studied,and I found at Beloit a new man in the Geology Dept.who was much interested in the local field,whom I promised to give a little aid.

You mentioned in your last letter Salisbury as having in charge a reinvestigation of the Winnebago-Boone County field,but as his death occurred soon after I judge the work was not finished. This field is of great interest locally,as it touches the Wisconsin area at Beloit,and the study of its Quaternary would determine whether the Wisconsin area is a simple drift of Illinoisan,or,as you have claimed,a complex from Illinoisn to Early Wisconsin. Clearly the last word has not been said of this field.

I had opportunityto go over the Walworth County field last summer,and find my criticism of Alden's work much strengthened thereby. In the first place,he ignores the Early Wisconsin development,that is so conspicuous in the McHenry County(Ill.) area,and which forms the massive ridge areas extending north from the Kane County complex. Each of these has its extension into the Walworth area,and had part in the determination of drainage areas and basins. I note three of these,Marengo River,Woodstock,and a third across the center of the County from Huntly to Hebron. The latter extended in a broken line acrosss the White River basin to the Elkhorn ridge.

The evidence of bowlder distribution is also of much weight in this field. Alden ignored this entirely in his work,with Dr.Chamberlin's approval,but more is involved than a few questionable quartzites. These I found coincident with your outline of Iowan drift in the region. A much more notable distribution from the Lake Superior ~~xxxxxx~~ copper belt extends acrosss this area,and confirms the diverse origin of the drift between the Illinois and Green Bay lobes. I have noted an abundant distribution of the Superior red quartz porphyry as far south as the Iowan drift as outlined by you in the Illinois Lobe. With these is the abundant native copper drift in the Wisconsin-Illinois area.

In reviewing the subject at this time,I am impressed with the lack of coordination of results of different observers. Yours in Illinois and Alden's in Wisconsin are a continent apart,and noone has linked the field closely with preglacial conditions. Briefly,the Wisconsin anticline as outlined by yourself has marked the division between St Lawrence and Mississippi basins since Paleozoic time. This puts the whole area under consideration into the St Lawrence basin,with the Milwaukee area as the point of outflow from the Wisconsin,Rock and upper Illinois areas. With this ~~xxx~~ idea in mind one may understand why the regular succession of moraines that note the deploy of icelobes is broken in the Wisconsin area,and in place of these a deployment adjusted to deeply eroded surfaces. Alden's map of southeastern Wisconsin outlines an adequate drainage line across each of the lime stone cuestas from the Wisconsin valley to the lake basin at Milwaukee. I own to a certain incoherence in this review,and put it forth with much question. If for no other purpose than to relieve my ownmind it

What does this mean

ay be worth the effort. It is supported,however,by strong evidence.
1st. The overlap of Devonian strata along the lake border indicates the lowest stratigraphic level on the west shore of the lake.
2d. The existence of a Milwaukee axis assumes a change of altitude of perhaps 200 feet in interglacial time.
3d. The deeply cleft drainage line shown by maps of the preglacial surface,and confined by surface contours,outline the preglacial course of an outlet as well defined as that of the Mississippi in Iowa.

confined?

This recognition clears up some obscure points in the Walworth Co. area. Well sections in the White River and North Nippersink basins penetrate from 175 - 400 feet of drift before touching rock showing deep lakeward slopes across the Niagara escarpment. At the same time the Elkhorn plateau,with its crest well above the 1000 foot contour,is a continuous topographic feature across Walworth,Boone and Winnebago counties,to Rockford,Illinois. The Lake Geneva valley crossing the escarpment,~~xh~~ marks the outlet from the Kishwaukee basin,in consonance with the Troy valley north of the Elkhorn ridge,the preglacial channel in each case being over 500 feet below the crest of the divide.

The Milwaukee axis with the attendant shallowing of the lake trough on one side and the discordance between the present and preglacial Mississippi drainage show change of altitude sufficient to reverse the drainage of each river valley within the area.

But the most important points in dispute lie in the Rock River valley,between theBloomington and Green Bay moraines,the area that Alden claims has a single drift sheet,from the Walworth moraines to the driftless area.

Leaving out the Iowan,which is as well established in geologic literature as the adjacent Early Wisconsin in the Illinois area,we have the two moraines emerging beyond the Bloomington border,on the south line of Boone County. Each of these show 100 feet of relief in the south tier of townships,and the inner a strong development where cut through by the Kishwaukee at Belvidere. Well marked marginal deposits extend the line across the northeast corner of Winnebago Co.to the Rock River at Beloit. On the Wisconsin side of the line the ridge,first described by Chamberlin,crosses the center of Beloit Tp.and appears in well marked gravel ridges at Hanover,Footville,and an isolated moraine in the wide marsh area SE of Evansville. A gravel pit in this city marks its continuance to the borderofthe Green Bay marginal. The outer ridge is less prominent beyond the Irene area,but appears in the area cut through by the river north of Irene Tp. A chain of gravel ridges mark the border across the divide between the Rock and Pecatonica basins half way between Rockton and Rockford. Coon Creek valley carries a belt of gravel ridges across Newark,and at Orfordville on the divide between Rock and Sugar River valleys the formation shows 50 feet of gravel in well sections. Allen Creek,southwest of Evansville,shows a succession of gravel ridges on its banks. This belt defines the drumlin area to the east. These forms may be distinguished on all the ridge areas adjacent,their elongation at right angles to the drift border.

not true of drift

On the east side of Rock River these diverge about 70° west,but on the east side of the area near the Walworth Co.line,they approach the meridian line ,from 10 to 20° west,the series forming a lobe of Early Wisconsin drift concentric with the Green Bay lobe of Late Wisconsin to the north. This lobe has all the characteristics of the Late Wisconsin within its border,marginal belt,thickened drift within,drumlin marked

and its own bowlder trains. It is of interest to note that in the meridional drumlin area of Allens Grove Tp. Walworth Co. hundreds of Lake Superior quartz porphyries are to be seen, erratics from this source forming fully half the country rock. This distribution was identified 80 years ago as pertaining to a bowlder train traced by its discoverer, C.C. Douglass, from the Keewenaw peninsula southward to Green Bay, and then identified in the Walworth Co. area, near his home, at Fontana, Wisconsin. This identity is further shown by the axial direction of the drumlin forms, which points directly up the Green Bay valley to the Michigan copper belt.

The Early-Late Wisconsin marginal development in the composite area, beginning with the Kane County esker region, is a continuous belt fringing the Valparaiso from the Marseilles border to the Kettle moraine in Walworth County. I traced its southward extension across the crest of Marengo Ridge to the head of the marsh land separating Marengo and Woodstock ridges SE of Harvard, Ill. where the characteristic morainic topography of the composite area is fully developed, serpentine ridges, knobs, kettles, and inclosed marsh areas duplicating the Walworth and Kane County moraines in their less massive relief. Alden's Elkhorn moraine appears to be the equivalent, in the Wisconsin area, of the Kane Co. belt, and the minor belts within this line recessionals conforming in outline to drainage basins.

One thing is certain, the Illinois-Wisconsin area bears a complex Quaternary development from overlapping glacial movements across and along the axials of the adjacent lake basins. Coordination of drift movements from distant centers down the widely divergent slopes is not probable, but is to be premised within the same topographic unit.

In my efforts to be concise, I doubt not you will find this summary obscure and disconnected. As I review these pages much in the way of illustrative evidence suggests itself, but I assume that you have these data well in mind. As I understand, the influence of other observers has modified your views in regard to the Iowan in the Wisconsin-Illinois area. The only thing I see that is questionable is its correlation with the Iowa sheet, and there only because of the Keewatin source of the latter. The drifts from the three centers appear to have passed in succession over the Minnesota area in Late Wisconsin time and probably neither can be said to have been coincident with the Kettle Moraine. This idea has come to mind: The Shelbyville moraine disappears on the border of the Bloomington not far south of the appearance of Iowan drift near Kewaunee. Is there any significance in this?

Yours,

Ira M. Buell.
409 S. Catalina Ave. Pasadena, California.

To Frank Leverett,
Univ. of Michigan,
Ann Arbor, Michigan.

September 1, 1925.

Mr. Frank E. Leverett,
U. S. Geological Survey,
Ann Arbor, Michigan.

Dear Mr. Leverett:

Your letter of July 17 has not yet been answered because I have been in the hospital and unable to work for some weeks. I think you are under misapprehension in stating that this outline still places the Kansan and Illinoian in the same stage. I suggested this merely as a possibility with the specific reservation that none of the doubts may have any value. I think you also misunderstand my attitude on the Iowan drift as well as the post-Kansan drift in northwestern Iowa. My idea is that the unmappable boundaries as well as the lack of proof of three drifts, one above the other at any point, are sufficient to cause a doubt that the topographic evidence means anything.

You will find the matter of the pebble concentration below the loess in northeastern Iowa is mentioned in the outline. My idea has always been that the absence of weathering may mean threerosion ratherathan less time. I think we are now agreed on this point.

I hope some day to see more of northwestern Iowa, but I have pointed out in the outline that as yet there seems to be no known spot where there are three pre-Wisconsin drifts in the same section unless we depend upon data of very questionable value. Should you know of any such place, I will be very glad to hear about it.

Yours very truly,

FTT-M

Geologist

DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

Ann Arbor, Mich. July 17 1925.

Dear Mr. Thwaites:-

I have been away from Ann Arbor since May 25, until this week, so did not see your outline that you sent some weeks ago till my return. I have not time now togo through it carefully, as I leave Monday for the field in the Ohio Valley. In glancing through it I was surprised to find that you are putting the Kansan and Illinoian into the same general stage of glaciation. The evidence is so strong against such a correlation that I cannot understand your position. If you had correlated the Illinoian and Iowan, calling the latter the Keewatin equivalent of the Labrador Illinoian I should be able to understand your position, for there are some lines of evidence in favor of such a correlation.

I have just been over the Iowan area with Kay and we are agreed that the deposition of the Iowan drift preceded that of the loess by a marked interval during which a pebbly concentrate was developed on the Iowan. This interval may approximate in length that required for the development of the Sangamon soil and weathered zone on the Illinoian drift.

We also visited northwestern Iowa and Kay is now fully convinced that the post Kansan drift that I have been contending for is really there, and that it is a probable correlative of the Iowan of northeastern Iowa. We have thus cleared away our differences and will have opinions in common on the drifts of Iowa.

Very truly yours,

Frank Leverett

GOVERNMENT PRINTING OFFICE

The Gladstone Hotel

RATES $3.00 PER DAY AND UP

C. C. MACOMBER, Proprietor

Fairchild, Wisconsin, May 27 1923

Dear Mr Thwaites:

I read your outline for glacial studies yesterday on my way up here and found it very interesting. On the whole the interpretations are in accord with my own views, and the method of attacking problems also.

The principal exception is found in the way you deal with the relative age of drifts, or rather with the question of glacial stages. I notice you quote the Irish Wrights as an authority on our drifts. This seems surprising for he has never studied them and his book shows that he has no real conception of the lines of evidence. His treatment is academic rather than scientific. He decides what is probable and then tries to make the case support what he considers probable. I presume

Fairchild, Wisconsin, _____ 192

He has never seen our topographic sheets, and knows nothing of the value they have in showing the greater erosion on Kansan than on Illinoian, and greater on Illinoian than on Wisconsin. If he has these sheets he does not know to what extent valleys are cut in drift and to what extent in rock. So I consider him unqualified to discuss the subject of the relative age of the drift sheets. Why do you not take Chamberlin or myself as the interpreters of these features rather than one who knows far less than we do about them? I fear your students will get too little of the real evidence of difference in age if they follow your outline. They should have the best American authorities on American drifts put in their hands.

Fairchild, Wisconsin, _____ 192

I wish you were here & look over the drift materials in this district with me. and the character of the ~~post~~ glacial erosion. It is very much greater than in the Wisconsin and the rocks are very much weathered, so I am inclined to refer it to an earlier time than Iowan. Weidman's latest view is that it is Iowan. I shall suspend judgment however, until I have gone over a considerable part of the field.

I will probably go to Menomonie with Mr Bean, and look into the age of the Menomonie Junction with him. That will be my field address about June 1st

Very truly yours.

Frank Leverett.