PROGRESS REPORT

of

GOLD SURVEY AND INVESTIGATION

under

Federal Emergency Relief Administration

Project S-F2-55

J. C. Allen, Supervisor
College of Engineering, U.N.D.

Introduction and History

In rendering a Report on Gold Investigation Project S-Fe-55 an attempt has been made to include all of the information made available thus far by the parties in the Field and the Staff of Laboratory Investigators working at the School of Mines, University of North Dakota. The report includes a section on "Field Methods", one on "Geology of the Lake Souris Basin" one on "Mineralogy of the sands and gravels" and the final section describing methods of assaying samples together with a summary report of samples taken, assayed, and their values. Two maps are presented in connection with the report: the first, "A map of the Lake Souris Basin", and the second, a map of Northern U.S. and Canada showing the relation of the ice sheet and the glacial drift to the Lake Souris Basin.

History

As early as May 1908 we find record of knowledge of the existence of Gold in the sands and gravel deposits of the Lake Souris Basin area. At that time L. E. Mills and D. B. Kauffman, and others filed claims for $E\frac{1}{2}SW\frac{1}{4}$, Sec. 23, Twp. 156 N. Rg. 77W., and $W\frac{1}{2}$ Se and $E\frac{1}{2}Se\frac{1}{4}$. Sec. 23 Twp. 156, R. 77 as placer mines.

By August 1, 1908 this group of people had organized themselves into a company called the Eldorado Gold Mining Co. As part of the articles of agreement they agreed "to co-operate and purchase a dredge or mining boat of sufficient capacity to do the work in the best possible manner."

Since that time there has been more or less knowledge that the sands contain a small amount of Gold, but it was not taken seriously until about three or four years ago when reports from Chicago showed that gold nuggets had been taken from crops of turkeys grown near Denbeigh.

As soon as this information became general knowledge, individuals and organizations began taking mining leases on plots of ground in the area until virtually all property subject to lease was so held by some person or group. Many experiments were tried by the installation of mining machinery and the erection of small treatment plants in different districts of the area. Rumors were widespread which both affirmed and denied the occurrence of gold in commercial quantities although no attempt of systematic prospecting or sampling was carried out. One after another the treatment plants proved failures, but each year new machines or plants took their places in different districts and rumor continued. During the past summer several plants were in the process of construction or operated for a short time.

During this period and up until the time of Gold Investigation Project S-F2-55, the School of Mines endeavored to establish definite information regarding the value of these sand deposits in order that inquiries relating to gold might be satisfied.

Numerous field trips were made to points where gold had been reported. Unfortunately, however, lack of funds for an investigation made impossible a definite statement of what might or might not be expected.

History (cont.)

In the summer of 1934 the School of Mines asked for assistance fbom the Federal Emergency Relief Administration. To this end a State Project was proposed and accepted resulting in "Gold Investigation Project" S-F2-55.

This project began early in August 1934 and has continued up to the present. The report includes assay results in about 4/7 of the 72 plots sampled in the field. Plots were sampled by bore holes on 330' centers but assay results thus far only include holes on 660' centers.

Gold Investigation Project S-F2-55

Report on FIELD METHODS By Walter Augustadt

In this project it was desirable to prospect as large a territory as possible. This had to be done as thoroughly as the time and money allowed would permit and yet cover a territory of approximately 3,000 square miles in such a manner that enough samples would be collected to be able to form a definite opinion as to the feasibility of mining operations in the area. Not only was it desirable to obtain samples enough to determine the extent and value of the sand deposit, but it was also necessary that these samples be taken in such a manner that the exact location and depth of every sample could be accurately recorded for future reference. In order to do this some definite method of proceedure that would stay within the limits mentioned above and yet give the desired results, had to be agreed upon.

Method of Selecting Ground

The method finally selected was to take 40 acre tracts: first, in all places where previous work had been done and it was claimed gold had been found: second, in all places where it was claimed assay results showed the presence of gold: and third, in as many places as possible where the geological formations showed that there had been water action and therefore concentration of any heavy minerals present. These later formations consisted mainly of river terraces, North and North East of Karsruhe, North of Towner, and along the Wintering River. Also in this class comes old outlet streams of Lake Souris such as the Big Coulee outlet running in a South Easterly direction from the big bend through the South East corner of McHenry County. The lower part of Wintering River was also considered as an old outlet and therefore under class three.

Sampling

It was decided that special samples would be taken in places which looked interesting but did not warrant sampling of an entire 40 acres due to their inaccessability.

It was agreed that these 40 acre tracts were to be sampled by means of twenty five holes or test pits spaced on three hundred and thirty foot centers, and that of these holes at least the four corner ones would be put down to bed clay or as deep as it was feasible to go within the money and time limits allowed.

In order to do this quickly and economically it was necessary to have some sort of drill capable of taking a core sample and to be able to case the hole as it was being augered, since in most cases the water table in the region lies at a depth of between 8 and 12 feet. The presence of water increases the cost and decreases the speed of prospecting work, and test pits are not practical since the expense of timbering, curbing and pumping water prohibits their use. Also the time and labor saved makes it desirable to rent or contract a machine capable of handling this formation advantageously.

The machine obtained was of the well auger type equipped with casing and special augers for handling the sand and gravel. It was contracted for a flat sum for twelve weeks work and was subject to move to any locality at the direction of the Supervisor.

Machine Sampling (cont.)

Five men were used to operate and do the sampling at the machine, one machine operator, one driller, one helper, and two samplers.

The hole was started and augered without casing until water was stuck; then the casings were put in and the auger turned down below the casing until it was full; then as the auger was hoisted the combined weight of the machine and the pull on the auger was used to push the casing down. The content of each auger was dumped on a canvas and this coned and quartered to approximately 15 pounds. This was placed on another canvas and the process repeated until a total depth of five feet had been reached. Then the sample was cut and quartered again until approximately 15 pounds remained. This was placed in a sample bag and labeled.

After operating this machine for a time it was found that the progress was slow, due to the necessity of putting down a large hole for the casing, sampling a large amount of core and moving and hauling of considerable amount of machinery and tools. It was seen that the territory could not be covered by this machine alone, therefore some other rapid method of taking these samples had to be found.

Drive Pipe method of Sampling

It was decided to try driving ordinary 2" galvanized well casing with a heavy hammer and then pulling and removing the core. The total equipment consisted of three 4" x 4" x 16' timbers fixed in such a manner that they could form a tripod when set up, 12-5' lengths of 2" galvanized well casing, one sheave, one hammer and guide, 30 ft. of 1¼" rope, 2 trimo 24" pipe wrenches, one differential chain host, and two canvases.

A post hole auger was first used to bore (down to water) a hole. The casings were then put in, and tripod with sheave and hammer set up. The hammer weighed approximately 135 pounds and was activated on a single rope by man power. A guide kept the hammer in place over the drive head. The casings were constantly turned to keep joints tight and five foot sections were added as the casing was drived. After the casing had been driven to bed clay or as deep as was possible, it was pulled by means of the chain hoist and pipe wrenches. The core was then measured and knowing the depth to which the pipe was driven, the amount of core to allow per foot of hole calculated. A better method perhaps would have been to remove the core at every 6" or foot that the casing was driven by breaking and washing to the surface. This method, however, involved too much time and money and could not be used.

This method of sampling worked remarkable well because the size of core taken was such that no coring or quartering os sample was necessary. The equipment was light and could be quickly assembled or taken apart and moved. The depth to which the casing could be driven was surprising and ranged from 25' to 56'. Coarse gravel 1-3/4" or larger could not be picked up. This was about the only disadvantage the equipment had in this region and such cases were few. The bed clay that formed the bottom of the core prevented any of the core from sliding out when the casings were being pulled.

Auger Sampling

The intermediate holes on a forty acre tract were put down by means of post hole augers, two men to each auger and samples were taken of every four feet in the same manner. Augers worked good except in loose gravel, or where large rocks were present. After striking water they were useless.

Staking out plots to be samples

In order that no mistake be made as to location where samples were taken the following method was used. Each forth acre tract was marked by means of stakes at the places where holes were to be put down. A stake was set on the South East corner and was marked No.1. The quarter, section, township, and range, was also marked on the stake. All of the other holes were staked and marked by number and also by their distance N and W of stake No.1. This served as a check and prevented mistakes. The diagram shows the manner in which the plots were marked.

25 1320 N. 1320 W.	24 1320 N. 990 W.	23 1320 N. 660 W.	22 1320 N. 330 W.	21 1320 N. 0 W.
20 990 N. 1320 W.	19 990 N. 990 W.	18 990 N. 330 W.	17 990 N. 330 W.	16 990 N. 0 W.
15 660 N. 1320 W.	14 660 N. 990 W.	13 660 N: 660 W.	12 660 N. 330 W.	11 660 N. 0.W.
10 330 N. 1320 W.	9 330 N. 330 W.	8 330 N. 660 W.	7 330 N. 330 W.	6 330 N. 0 W.
5 0 N. 1320 W.	4 0 N. 990 W.	3 0.N. 660 W.	2 0 N. 330 W.	1 0 N. 0 W.

All samples taken were put in sacks and tagged, the tags giving the hole number, the distance N. and W. of No. 1., the quarter, section township, range and depth at which the samples were taken. A record of each sample was also kept in a field book and the type of soil, depth at which water was struck and other peculiarities noted.

Sample bags

It was found that the expense of purchasing sample bags ready made was prohibitive so ordinary muslin cloth was purchased and the sacks made by relief labor on a sewing project. This not only saved considerable money on sample bags but also provided labor for relief cases on sewing projects in the County.

Trucks and Labor

Trucks were used for transporting men to and from work and for hauling samples to Grand Forks. All men and trucks used were relief cases, and were paid for from relief funds. This project not only had its benefits in that it would prove or disprove the feasibility of mining in this territory, but it also furnished work to men in an area where there were a good many families on relief. The project kept approximately 25 men, who were taken from relief rolls, at work for a period of four months.

Summary

A total of 72 plots of ground averaging 40 acres each were staked out and sampled on 330 ft. centers. In this manner 5,000 samples were taken, each averaging four feet in depth, or total 20,000 ft. hole was put down. About 85% of the samples were taken by means of hand augers, the remaining 15% being taken by means of the Drive Pipe Outfit and theWell Machine.

If all field costs are assigned to samples then the cost per foot of sample can be stated at approximately $0.40.

Geology of the Glacial Lake Souris Basin

Report on by J.C. Allen

In considering the occurrence and the possible origin of gold in the area which is under investigation, it is interesting and of value to consider the present and the past Geology of the district.

There is little or no doubt that the gold found in the sands and in the gravel deposits of McHenry, Ward, Bottineau, and Pierce Counties is of glacial origin. That is, the gold was transported in the drift material that the ice sheet carried along in its path as it moved down from the North and Northeast.

This conclusion is based upon the fact that the gold is found in connection with gravel deposits that are foreign to North Dakota. Many of the rocks found in the gravel are of Igneous origin and these could not possible bear any relation to the outcropping Cretaceous Sedimentaries of North Dakota. Many of the rocks have flat sides ground smooth by their contact with other rocks as they were held tightly frozen in place on the bottom of the moving mass of ice. It would seem natural to connect up the Igneous rocks and therefore part of the drift with the Igneous rock formations of Northern Canada which outcrop, forming that vast area known today as the Pre-Cambrian shield of Canada.

Floor of the Ice Sheet

Let us study for a moment some of the conditions pertinent to our investigation as they were in Pre-Glacial times just before the ice movement began.

The outcropping rock formations which formed the floor over which the ice sheet moved was comprised principally of: the Archean, the Silruian and Devonian, and the Cretaceous formations.

The Archean, which is also called the Pre-Cambrian Shield of Canada, stretches from Labrador south to Lake Huron, west to Lake Superior, then northwest and north to the Arctic Sea. On the sourthwest the Archean is bounded by a rather narrow strip of the Silurian and Devonian sedimentary formations; and this in turn is bounded by a great expanse to the south and west of the great sedimentary beds of the Cretaceous formation.

Direction of Movement and Centers

From the many records left on this rock floor as glacial striations or scratches, it is possible to trace approximately the path or the direction which the ice sheet took. From this same data it is also possible to determine the "Centers" where the ice first began to formaand move out over the area to the south and southwest.

The ice that affected the Lake Souris Area seemed to center in and around the Gods Lake district of northern Manitoba, and to some extent, to the south of that region in the Lac Seul district of northern Ontario, and also to the north of Gods Lake, around the Flin Flon district.

Due to the sudden change of climatic conditions and a period of long winters and short summers ice accumulated at these centers faster in the winter than it could melt away in the summer and gradually the ice began to move outward from the region of its greatest thickness toward its margin, moving in a sourth and a sourthwesterly direction. The superficial material overlying the rock mantle which was in the path of the advancing ice sheet, was everywhere plowed up and worked over and upon the disappearance of the ice it was left in a deposit of clay, sand, gravel and boulders in a confused mass.

Glacial Drift Deposits

The glacial drift material which is everywhere in evidence in the Lake Souris Basin and surrounding area to the northwest, must have been accumulated by the ice in its path from northern Ontario and Manitoba moving in a south and southwesterly direction into North Dakota.

A particular area of interest is that which is bounded by old Glacial Lake Souris on the east, by the Coteau de Missouri on the sourth and by Glacial Lake Saskatchewan on the west. Evidence points to the fact that a great quan*tity of drift material was transported from the ice centers previously mentioned and dumped into this area. Because of its proximity to the edge of the ice sheet the district in North Dakota located at the headwaters and along the courses of the Great Glacial Revers Des Lacs and Souris may contain a great portion of this material. These rivers carrying the water away from the edge of the melting ice cut wide and deep channels carrying along a tremendous load of gravel, sand, silt, and boulders from the glacial drift stratifying it along its course and subjecting it to a "concentrating action".

At least Four Glacial Moraines were left by the receding ice sheet on the sourthern border of Lake Souris. They extend from the area to the south east of the shore line into the lake bottom itself inaa northwesterly, south easterly direction as far as the present channel of the Souris River and a little beyond. The moraines are not nearly as distinct in the lake bottom as outside the boundary, for the have been leveled a good deal by the action of the waves until now they are gently sloping or undulating. One can trace the lines of hills of a moraine across the lake bottom in many places by the rolling and undulating character of the land surface. The lake bottom hills have low rounded smooth surfaces quite different than the irregular heaps and ridges of clay, sand, and boulders, which make up the moraines east of the lake shore.

Gold from the Pre*Cambrian Area

In moving over the great Pre-Cambrian area the moving mass of ice no doubt encountered outcropping veins of gold bearing lode material and possilby deposits of superficial material containing gold placers. This material was plowed up, worked over and carried along later to be deposited in the heterogeneous mixture of glacial drift. In the areas which we are considering in northern Canada there are many known outcrops of mineral known to exist at the present time.

Mines around God's Lake in Northern Manitoba include Little God's Lake, East God's Lake, Smelter Gold, and the God's Lake Mine. A short distance to the south of the south shore of Island Lake are located Island Lake Mines, and Copeland Gold.

Another mining region which may have been crossed by ice on its way to the region at the upper portion of the Glacial Revers Des Lacs and Souris is the important Central Manitoba area. This area includes the properties of the Hudson Bay Mining and Smelting Co., the third largest mining and smelting operation in Canada. The lode material consists of a complex Zinc Copper, Gold, Silver ore. The Sherrit Gorden mines, another Copper Zinc, Gold mines, the Manitoba Flin Flon Mines, and others.

North of the Lake of the Woods and centering around Lac Seul we have another district which includes the famous Red Lake Region, which may bear some relation to North Dakota Gold. This area is literally dotted with properties over a large radius from Lac Seul. It is a relatively new district and most of the properties are in the state of development. In the last few years the area has been prospected on a large scale and many rich strikes have been made.

Glacial Lakes

With the first retreat of the ice from the Missouri Coteau, Glacial Lakes began to exist in the valley of the south Saskatchewan forming glacial Lake Saskatchewan and in the upper Souris basin forming glacial Lake Souris. As the ice receded further glacial Lake Agassiz was formed. Lake Saskatchewan for a time drained into Lake Souris and Lake Souris in turn was completely drained into Lake Agassiz.

Lake Souris

Lake Souris occupied the basin of the Souris River from the most southern portion of the river s loop in North Dakota to its elbow in Manitoba. It was about 170 miles long and about 80 miles in width and covered an area of about 2,000,000 acres in North Dakota and an area of approximately equal extent in Manitoba.

Outlets of Lake Souris

Glacial Lake Souris did not exist for a very long period and it was quickly drained after the formation and extension northward of Lake Agassiz. This rapid drainage of the lake and the outlets through which it was drained may have some possible relation to the investigation so they are mentioned below.

The first outlet was to the south by way of the broad valley which extends from near Velva, N. Dak. to the Missouri River.

After the ice had melted further back the outlet changed to that of the Big Coulee and southward into the James River and ultimately into glacial Lake Dakota.

With the deepening of the second channel the waters were diverted into the Cheyenne River and thence to Lake Agassiz.

As the Lake grew larger upon the further recession of the ice another outlet which was lower than that of the Big Coulee outlet was formed north east of the Turtle Mountains by way of Badger Creek, Lac Des Roches, the Mauvaise Coulee, into Devils Lake.

This last mentioned outlet did not remain important for long, for seon after Lake Souris was drained rapidly into Lake Agassiz by the Pembina River. The Lake was drained suddenly 125 feet shortly after this new outlet was formed and then an additional 110 feet as the channel was cut down to the level of the bottom of the lake.

All of the outlets of Lake Souris are well marked by fairly wide and deep valleys, the most striking of which is the valley of the Pembina. The Pembina channel is eroded 100 to 300 feet along the greater portion of its course and 300 to 450 feet along the last twenty five miles.

Lake Souris Basin

The material or deposits found in the basin of the glacial Lake Souris in the region with which we are concerned is made up of several types of material.

First we may think of the Delta deposit of the fine sand and suspended matter spread in a fan-shaped deposit over the bottom of the lake from the point where the waters of the glacial River Souris came in contact with the Lake waters. This delta may have been formed and reformed from several different points as the lake first expanded toward Minot and receded to a point about 10 miles northwest of Velva on the Souris River. After forming the delta the glacial River Souris may have cut its own channel through the delta as the shore of the receding lake moved eastward.

The moraines which are composed of belts of hills extend into the lake bed of Lake Souris in the southeastern portion. They are parallel to each other and extend up to and in some cases across, the present channel of the Souris River. These morainal hills, as was mentioned above, were subjected to wave action by the waters of the lake. This caused them to become rolling and undulating and at the same time caused the material to be spread out over a greater area on the lake bottom. This type of deposit or material is very common in the sourtheastern area of the lake bottom. It is perhaps typified by the following log taken of a bore hole on Sec. 20. 155, R. 77:

0' to 7' Sand
7' to 17' Rocks and coarse gravel
17' to 21' Gravel and bits of lignite coal
21' to 29' Grey sand
29' to 32' Blue clay

While the sand deposits of the area have been assigned to the sandstone beds of the Turtle Mountains, they do not begin to make up the bulk of the material, much of which consists of coarse gravel and boulders. The rocks and boulders are mostly of igneous material and therefore must have originated in northern Canada.

Getting away from the morainalareas of the lake bottom we find flat level prairie land. The bottom here, as we might expect, consists of sand and clay deposits and little or no gravel is found. Boulders and rocks are scattered over the lake bottom, however, and these may be explained by floating cakes of ice carrying drift material which was dropped to the bottom as they melted. A log which is somewhat typical for low flat areas is the following recorded from

Hole #5, Sec. 21, 155, 77:

0'	to 7'	sand and clay
7'	to 17'	sand and mud
17'	to 19'	sand and heavy clay
19'		lake bottom

Occurrence of Gold in the Souris Lake Basin

The district south of Benbeigh has held the center of interest of the entire area for several years. Many samples have been taken by private parties and on the basis of the reported assay values several small machines or treatnent plants were operated unsuccessfully for a short time. Gold, if it occurs, may originate in any of the following sources: river delta deposits, glacial drift found in the moraines, or from sediments or sand deposits composed of material from the sandstone beds of the Turtle Mountains or other North Dakota outcropping beds.

Material brought in by the River Souris in glacial time and forming the delta deposit must have been of very fine material for the heavier material composed of rocks and gravel was dropped along the stream bed in the natural channel. The material carried out into the lake then must have been suspended material. This type of material could only contain gold in an extremely finely divided state. The physical condition of such gold would make it unrecoverable by known methods of ore treatment.

The gravel in the morainal deposits might contain gold in place in the rocks or boulders or in a free state in the finer material which has been subjected to grinding action. If this gravel originated in the pre-cambrain deposits it is conceivable that this might be the case. The chances for concentration, by wave action, of the   does not seem likely to have taken place to any great extent. Along stream beds and in the vicinity of lake outlets gold bearing material might have been worked over and the gold concentrated.

That any of the occurring gold should have originated from the North Dakota Cretaceous beds seems highly improbable. These beds themselves are not known to be mineralized and as they are marine deposits nothing greater than the minutest trace would probably be present if at all.

The above discussion applies to the materials found in the lake bed the morainal deposits within the borders of the lake, the wide flat prairie areas, the delta deposit and along the river channels within the basin and the old drain age outlets of the lake.

Future Investigation for Gold-bearing Material

During the past summer and fall particular attention was paid to that area within the border of Old Glacial Lake Souris. This work done, accomplished a thorough and complete examination of the lake bed and included testing of plots in all localities. A good deal of stress was put on the morainal deposits which are so prominent in the south and southeastern portion of the lake bed. Many plots were sampled along that portion of the

Souris River which lies within the lake bed. Plots were also located in districts typical of the flat lake bottom areas composed of sand and clay. As yet, however, no sampling or prospecting has beenddone along the old outlet channels of glacial Lake Souris. Some work was doae south of Minot in the valley of the glacial River Souris where the river probably cut its way through its own previously formed delta deposit. No work has been done prospecting or sampling the wide and deep valleys of the glacial Rivers Des Lacs and Souris, north of Logan.

The work done near Logan on the Brand Farm is described by L. C. Harrington in a report to the State Planning Board made November 13, 1934, so it need not be repeated here. A more complete list of assays of samples taken is now available and a discussion of these results is mad e in another part in the report.

From a practical standpoint and based also on the findings near Logan it would seem that the entire channels of the glacial Rivers Des Lacs and Souris should be prospected if future investigation is made possible. The glacial River Souris extends from a point about 10 miles northeast of Velva in a northerly route to its source near the Canadian boundary. The Des Lacs River has its cource near the border and it flowed south joining the Souris River at a point about 10 miles northwest of Minot.

Both of these glacial rivers carried a tremendous amount of water from the melting ice sheet edge, and they also carried heavy lodds of sand and gravel from drift deposits. These deposits are stratified and the boulders strewn along the valley floors. The valleys vary in width from half a mile to a mile or more and they cut deeply The river load was subjedted to a great concentrating action and if deposits of gold-bearing material did exist in the drift which was carried along by these giant streams, then it is highly possible that deposits exist where the gold was concentrated. If these deposits do exist perhaps some may be found which are of commercial value.

While the Souris and Des Lacs River areas seem to bear the greatest possibilitties of the finding of commercial deposits of gold-bearing material, it is also felt that the fice outlets of old Lake Souris should be investigated. These outlets had broad well-defined valleys and they fed streams which carried large volumes of water. These streams were capable of concentrating gold or other heavy mineral encountered in the drift. It is not likely that these streams came in contact with as much virgin drift material the already worked over lake bed material.

Acknowledgements

In writin the report on "Geology" considerable information was derived from the sources listed below:

Glacial Lake Agassiz by Warren Upham (Monograph 25 U. C. G. S.)
The Story of the Prairies by Willard

U.S.G.S. Map of North Dakota by Staack and Hassan 1920
Minot Quadrangle Man U.S.G.S.H.G. Fram
Sawyer Quadrangle Map U.S.G.S.H.G. Fram
Maps used by Warren Upham in his Glacial Lake Agassiz
Map of the Mines of Candda published by James Richardson & Sons.

Report on Mineralogical Investigation of Glacial Lake Souris Drift Deposits By G. Grable

Introduction

The samples taken on the J. J. Brand Farm, S. E. of Logan, N.D., in the basin of the old glacial Lake Souris and submitted for assays showed values of interest and possible importance, and created a necessity for more information on the formaand occurrence of the gold, the nature of the gangue minerals, and the association of the gangue minerals with the gold. It was possible for the gold to be in the deposit in three conditions: namely, free gold, gold inclosed in the gangue minerals, or in the fomm of more rare occurrence, that of gold tellurides.

Proceedure and tests

The nature of the occurrence of the gold and gangue minerals in the deposit were determined by mineralogical tests.

The usual methods such as specific gravity, color, hardness, streak and crystal form, were not practical generally speaking because of the small size of the mineral grains examined. Petrographic methods, and tests for effervescence, lustre, blow pipe analysis, and chemical tests, were used where applicable; but most of the minerals could be identified by the index of refraction method, and hence this method was the one used in practically all cases.

Index of Refraction Method

Refraction is the phenomena of light being deflected when passing obliquely from one medium to another.

The index of refraction is the ratio between the sines of the incident and refracted angles of the light on passing from one medium to another. This ratio is distinctly for all minerals and liquids which are non-opaque and for this reason was the method most generally used. The opaque minerals and rocks were easily identified by other methods.

The immersion method, a more accurate and more easily applied method, though indirect, was used to find the index of refraction of the minerals which were non-opaque in character. In this method the index of refraction of immersion liquids are accurately determined with an ABBE refractometer. These liquids after standardization should cover an indirect range from 1.40 to 2.20, with the maximum allowable gap between two successive liquids not to exceed .015. Over 90% of the known minerals will have an index along this range.

Application of Immersion Method

For identification, a mineral grain was ground to 100 mesh, pleaces in a drop of standardized immersion liquid on a microscope slide, covered with a thin cover glass, and put under the objective of a petrographic microscope.

The field showing the mineral was obliquely illuminated by rotating the mirror under the stage until the correct degree of illumination was obtained. With the powdered grains in sharp focus the field should have the appearance illustrated in the figure

Bright Dark

H

L

Dark Bright

One of the minerals is more brightly illuminated than the other. With a mineral of lower index of refraction than the liquid, the bright edge will be on the side toward the shadowed half of the field. H in the figure above, represents grains with indices respectively lower and brighter than the liquid in which they are immersed. If the mineral was immersed and found to have a lower index of refration than the liquid, another liquid somewhere lower in the range was used to immerse the mineral and observation was again made. By repeated trials a liquid was found which had the same index of the optical constants of minerals. In most cases the results obtained readily identified the mineral.

Methods for Non-opaques

If opaque minerals were being determined, lustre, chemical tests, blow pipe tests, cleavage and magnetic susceptibility tests were made.

General

After becoming acquainted with all of the minerals under the microscope, most of the identification was done by sight, and the percent analysis by count.

Immersion media used

	Index of R.	Dispersion	Remarks
Water	1.333	slight	Dissolves many minerals
Pentasol	1.409	Slight	with low indices
Amyl Alcohol	1.410	"	
Valvolene (A)	1.423	"	
Bromoform	1.423	"	
Kerosene	1.453	"	
Valvolene (B)	1.462	"	will not mix with clove oil
Valvolene (C)	1.475	"	
Valvolene (D)	1.490	"	
Toluene	1.496	"	
Valvolene (E)	1.501	"	
Chlorobenzene	1.523	moderate	
Meta Cresol	1.539	slight	
Oil of Clove	1.547	moderate	will not mix with petroleum
Bromobenzene	1.557	"	oil
Orthotoluidine	1.569	"	
Aniline	1.580	"	
Oil of Cinnamon	1.608	strong	
Iodobenzene	1.608	moderate	
Bromo naphthalin	1.657	slight	
Methylene Iodide	1.737	rather strong	rather expensive and discolors on exposure- a little Cu of Sn in bottle will prevent this
Methylene Iodide saturated with Iodides	1.868	very strong	
Piperine and Iodides	2.10	strong	

note: most liquids in the above list mix easily with the succeeding or preceding it and the resulting mixture has an index between the two indexes of the liquids mixed.

Data Sheet

Material taken from Pit 3, Brand Farm, NESE Sec. 30, Twp. 154, Rg. 81. Near Logan, N.Dak.

Wilfley Table Products

Minerals or rocks	First Run Conc. -20 60	Conc. -60	Mid. -20 60	Mid. -60	Tails -20 60	Tails -60	Second Run Conc. -20 60	Conc. -60	Mid. -20 60	Mid. -60	Tails -20 60	Tails -60
Muscovite					1	4						
Biotite						9				80	45	19
Quartz	6	12	33	54	55	33	30	19	40			35
Garnet	58	40	31	2	2	Tr	40	35	Tr			
Apatite		Tr		Tr								
Spinel												
Limestone			1	4	13	25	3	5	8	1	18	5
Sandstone												
Seyenite												
Felsite											5	
Hornblende	2	5	13	6	4	3	17	8	5	6		8
Pyroxene			3	2		1	7		6	4		
Feldspar	6	13	15	30	25	25	3	23	40	9	30	23
Magnetite	28	30	4	2				10				10
Basalt											2	
Total	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%	100%

Gold .002 oz..045 oz. Heads on -20 60 .00121 oz$0.04;-60;.004 oz$.14
$0.07 1.54

Jig Concentration Products

Minerals or Rocks	First Run Conc. -8 14	Midds. -8 14	Tails -8 14	Second Run Conc. -14 20	Midds. -14 20	Tails -14 20
Muscovite	6					
Biotite						
Quartz	6	25	40	46	44	48
Garnet	4	1		6	3	
Apatite						
Spinel						
Limestone	50	40	40	25	28	30
Sandstone		8	4		4	
Seyenite		5			3	
Felsite						
Hornblende				3	1	
Pyroxene	5			4	2	
Feldspar	15	6	10	7	6	20
Magnetite				1	1	
Basalt	20	15	5	8	8	2
Total	100	100	100	100	100	100

Summary of Minerals and Rocks in Sands

The sands examined contained the following minerals and rocks: Hornblende, Muscovite, Quartz, Garnet, Apatite, Spinel, Calcite, Feldspars, Biotite, Pyroxene, Magnetite, and Gold as minerals; and Felsite, Seyenite, Limestone, Basalt, and Sandstone fragments of rocks.

Quartz is the chief constituent of the sand but there are also appreciable quantities of rock-making minerals such as Hornblende, Pyroxene, Feldspar, Mica, Garnet, and Magnetite. Fragments of Sedimentary and Igneous rocks are also present, Limestone being the chief constituent. The sand may be said to be derived from both Igneous and Sedimentary Rocks and to some extent to Metamorphic Rocks.

Gold was found in concentrations of the sands. It appeared as small grains well rounded and worn. The grains were pitted and flattened. These facts indicate that the gold has been subjected to stream action and weathering. It is similar in appearance to gold found in placer deposits. In the limited number of tests and observations made, no gold was seen in other but the free state, altho it is possible that the gold also occurs with quartz or with some other mineral or rock as a ganaue material, no occurrence of gold in this manner has thus far been observed.

Rocks Characteristic of the Gravels

While little work has been done in examination of the gravels which range in size from a quarter of an inch in diameter to large boulders several feet in diameter, it can be stated in a general way that a good proportion of the rocks are Igneous or Metamorphic.

On the J. J. Brand farm 120 rocks were picked up at random from pits being dug on Sec. 30 behind the granary. They were picked from specimens and no attempt was made to obtain an average sample of rocks. It is interesting, however, that 81 of these rocks were of igneous or metamorphic origin while only 39 were of Sedimentary origin.

The Igneous rocks consisted of fine to coarse grained Granite, Diorites, Gabbros, Seyenites, and Basalts. Schist, Gneiss, and Quartzite were represented among the Metamorphic rocks and the Sedimentary rocks consisted mostly of Limestones and Calcareous Sandstones.

Further Investigation

The work thus far done in examination of the sands and the gravel deposits cannot be conclusive for it is not complete. It is hoped that time will be available for a comprehensive study of sands and gravels from each of the 72 plots thus far examined or sampled, or from those which are most interesting because of their gold content.

The plan which is to be followed in the future would consist of the examination of the sands from the gold-bearing material from each plot both before and after concentration. Assays will be run on the products and a study will be made of the free gold found in concentrated samples.

Along with this, examination of gravel deposits in important areas should be made and a calculation of the Igneous Rocks and Sedimentary Rocks found as compared to the Sedimentary Rocks from the same deposit. This would be helpful in determining what portion of the drift was transported from the Pre-Cambrian and might prove helpful in the future location of gold-bearing deposits.

Seſection of Samples

From August 1, 1934 until Dec. 15, 1934, a total of 5199 samples were received from the field. The samples were checked, tabulated, and given laboratory numbers. Samples for assay were selected on 660 ft. centers from each plot, and the remaining samples were stored.

Equipment

Equipment includes: laboratory Jaw and Disc Cruchers for pulverizing samples, riffle sampling equipment, one gas fired fusion furnace, capacity 6-2a.t. crucibles, one DFC gas fired single muffle cupelling furnace, one electric annealing furnace for annealing gold beads, one fine balance for weighing gold beads, one cupel machine and other auxiliary equipment.

Charge for fusions

From the beginning of the project about August 1, 1934, a suitable charge for fusions was calculated and used giving good results. This charge was used until Jan. 21, 1935 when a second charge was substituted. It was felt that an equally suitable charge from the standpoint of slagging qualities could be found which would be cheaper from the standpoint of cost of reagents used.

Forty-five test fusions were run in order to ascertain the proper charge. These fusions were run in three sets of three each, nine fusions composing a group and five different groups being run. In each set in the group a different ore was used with the same amount of Litharge and Soda and the effect of borax glass added was observed by varying the amount added as 5 grams, 10 grams and 15 grams. In the five groups the Litharge which is the most expensive reagent was constantly decreased in amount while the Soda was increased a bi-sillicate being maintained. The PbO was reduced from 140 grams to 80 grams and the Soda increased from 47 grams to 75 grams. A comparison of the charge used up to January 21 (charge No. 1); and the charge selected as a result of the test fusions (charge No. 2) is made below with the cost of each.

Reagents	Wt. Grs.	No. 1 (bi-silicate) Cost per 1000 Fusions	No. 2 (Bi-silicate) Wt. grs.	Cost per 1000 F.
PbO	140	$41.83	80	$23.90
Soda	47	4.96	75	7.92
Borax	cover	.42	cover,5	2.13
Argols	3	1.05	2.5	.88
Totals		48.26		34.83

Three types of ore were used in the test fusions representing all variation of material to be assayed. The first was purely silicious, the second a mixture of sand and xix clay, and the third nearly pure clay. The charge selected works equally well on all three types of material, resulting in viscosity at the fusion point, liquidity at the time of pouring, and a clean slag which separates well from the lead button.

Operation

Two operators are used, one taking care of the fusions and the cupellations and the second performing the parting and weighing. Forty-eight fusions are made and supelled during each 8-hour day. The silver beads resulting from silver being imquarted with the lead button, are parted, annealted, and weighed on the following day. Furnaces are operated 5 days a week, 240 assays.

Cost of Assaying

The practice of running double fusions or check assays on each sample was followed up to January 21, 1935. At this time it was decided that there was no necessity of running check assays if careful sampling was executed. Therefore after January 21, 1935, only one fusion was run on each sample, and any samples showing values were then repeated for a check. In this way the furnace capacity and the number of samples completed per day was doubled, and the costs of assay per sample, reduced 50%. A tabulation of costs for the two methods follows, Method 1 being the one used up to January 21, 1935, and the Method 2, the one which is followed at the present time.

	Method 1	Method 2
1000 Samples		
Cost of Reagents	$96.52	$34.83
Crucibles	88.46	44.23
Cupels	17.00	8.50
Crushing	160.00	80.00
Fuel	120.00	60.00
Operators	400.00	200.00
Total	$881.98	$417.56

Approx. Cost Per Sample

Progress

August 1, 1934 to February 21, 1935

Fusion made	2596
Samples reported	1488

August 1, 1934 to February 31, 1934

Fusions made	1446
Samples reported	723
Samples checked	723
Crucibles used	501
Fusions per crucible	2.89

January 21, 1935 to February 21, 1935

Fusions made	1050
Test fusions	45
Samples re-checked#	130
Samples reported (new)	875
Crucibles used	372
Fusions per crucible	2.82

Samples re-checked were all previously reported before Jan.21

Furnaces were not operated from December 31, 1934 to January 21, 1935

A tabulated list of samples taken, assayed and reported, together with the results obtained up to this time follows.

Summary of Assays

Plot	Twp.	Rg.	Sec¼	District	Samples taken;	assayed	Au. traced;	Au. values;	Range of value
1	151	76	5SWSW	Brush Lake	76	29	none	none	
2	153	76	4 NWSW	Rich Machine	78	34	1	none	
3	153	76	4 SENW	N " "	76	49	13	none	
4	153	75	22 NWSW	Dry Lake	87	34		17	0. 12
5	153	75	36 SWSW	Round Lake	100	33	none	1	0.28
6	153	76	13 SWNW	S.E. Shore L. S.	110	35			
7	153	76	16 NENE	N. Round Lake	66	59	7	none	none
8	153	78	29 SESW	Klempes	79	65	2	3	.10-. 52
9	153	78	30 D.D.	Klempes	13	13	none	none	
10	153	78	32 SWSW	Klempes	78	33	5	none	
11	153	78	36 NW	Esker	78	31	none	none	
12	153	79	24 NWSE	S. Falsen	27	27	4	1	0.17
13	153	79	31 SWNW	Near Velva	95	39	11	none	
14	153	80	26 NWNE	Velva District	84	31	3		
15	154	76	22 NENW	N. E. of Karlshrue	70	26			
16	154	77	1 SESE	" "	57	26			
17	154	77	2 SESW	" "	93	43			
73	154	77	3 SWSW	" "	110	43	1		
S-1	154	77	4 NWNW	" "	6	6	2		
18	154	77	36 SESE	" "	79	34	6		
19	154	78	12 SESE	Souris Delta Dist.	45	24			
20	154	78	16 SESE	" " "	98	30	4		
21	154	78	28 SWNW	" " "	98	29		1	2.10
22	154	81	20 SWSW	Logan Dist of BrandF.	20	20	8		
23	154	81	29 SWNW	" " "	28	28	23		
24	154	81	30 NESE	" " "	40	40	20	12	. 09-1.23
25	154	81	32 NWNW	" " "	50	50	29		
26	155	75	32 SESE	SandHills SE of Towner	39	114	14	1	1.32
27	155	75	33 SESE	" " " "	75	75	15		
28	1557	76	6 SESW	Eaton Ranch Dist.	112	44			
29	155	77	1 NESW	" " "	100	51			
30	155	77	2 NWSE	" " "	81	28		2	.30-.70
31	155	77	7 NWSW	South of Denbeigh	95	36	1		
32	155	77	16 SWSW	" "	93	16			
33	155	77	18 SESW	" "	113	81	6		
34	155	7719	SENE	" "	82	36			
35	155	77	20 SWSE	" "	117	36			
36	155	77	21 SWSW	" "	120	45			
37	155	77	24 SESE	" Denbeigh on Souris	87	34	1		
38	155	77	26 NESW	" " " "	61	26	11		
39	156	76	30 SESW	Eaton Ranch Dist.	85	30	2		
72	156	76	8 NWNW	West of Towner Dist.	94	35		4	.17-1.75
40	156	76	31 SENW	Eaton Ranch Dist.	51	18	3	4	. 17-1.75
41	156	77	11 NWSW	West of Towner Dist.	80	29	3		

Plot	Twp.	Rg.	Sec.¼	District	Samples taken;	assayed	Au. traced	Au. values;	Range of value
42	156	77	16 SWSW	North of Denbeigh	68	31			
43	156	77	36 SWNE	Eaton Ranch Dist.	64	45	2		
44	156	78	5 NWNE	North Lake Dist.	97	41		2	.17-.28
45	156	78	5 NWSE	North Lake Dist.	63	27	2	5	.12
46	156	78	16 SESE	" " "	66	24			
47	156	78	24 SWSW	" " "	38	38		1	.35
48	156	79	SWNW	" " "	73	33	1	1	.70
49	156	80	13 SENE	" " "	73	24	2		
50	157	75	16 SWSW	S. E. of Towner Dist.	83	39		1	.70
51	157	75	7 SENE	North of " "	66	31		3	.09
52	157	75	8 SWNW	North " " "	99	41	6		
53	157	75	21 NWNW	North " " "	89	33	1		
54	157	75	32 NWNW	North " " "	83	41	1	2	.3585
55	157	75	36 NWNW	North " " "	62	24	2		
56	157	76	4 NWNE	North " " "	66	32	4		
57	157	76	24 NWSW	North " " "	89	33		1	.70
58	155	77	18 NWSW	North Lake Shore Dist.	72	26			
59	157	77	36 SESE	West of Towner "	70	28	9		
60	157	78	7 SWSW	North Lake Dist.	63	26	1		
61	158	76	18 SESE	North of Towner Dist.	107	43	3		
62	158	75	30 NWNW	North " " "	94	39	6		
63	158	76	16 SWSW	" " " "	72	27	4		
64	158	76	22 SESE	" " " "	71	30		3	.28
65	159	76	35 NWSE	" " " "	73	40	2		
66	159	77	28 NENE	" " " "	46	37			
67	159	77	27 NWNW	" " " "	17	17			
68	159	77	32 NWSE	" " " "	79	28			
69	159	78	24 NESE	" " " "	18	10	1		
70	160	78	31NWSW	" " " "	38	38	1		
71	160	78	31 NESW	" " " "	18	18			
72	156	76	8(recorded on page 1)						
S-2	156	76	29 NWSE	Eaton Ranch Dist.	4	4	1		
S-3	159	78	24 NWSE	North of Towner Dist.	15	15			
S-4	154	81	20-30	Brand Farm specials	28	28	4		2.52-3.50
					5480	2636	248	65	~~x09x3x~~ .09-3.50

4

Summary of Plots showing values

Section 4 (SENW) Twp. 153 Rg. 76 South of Towner Plot No.3

76 samples taken, 49 assays completed, 13 traces from Holes, 2,3,12, 13, 14 15, 16, 17, 18, 19. The topography is level to gently rolling. The deposit consists of sand with very little gravel to blue clay at 19 feet. The water table lies approximately 10 ft. below the surface. This plot is located on the same section that small cyanide and water concentration plant, which was being erected during the summer past, is located.

Section 4 (NWSW) Twp. 153 Rg. 76 South of Towner Plot No.2

76 samples taken, 32 assays completed, 1 trace, no values. The plant mentioned above is located on this 40 acres.

Section 29 (SWSW) Twp 153, Rg. 76 Near Round Lake Plot No. 5

100 samples taken, 33 assays completed, 1 value
Hole 25 - 15' to 27' carried .0087 oz./t Au. or $0.28. No traces.

Section 29 (SESW) Twp. 153, Rg. 78 S.W. Karlsruhe Plot No.8

79 samples taken, 29 assays completed.
Hole,1, 8'-12',. 01 Oz/t. $0.35; Hole 13, 0'-4',.0028 oz./t.,$0.10
Hole 21, 19'-20',.015 oz./t. $0.52. Located on rolling ground adjacent to a chain of dried up lakes which formerly drained into the Souris River. The deposits are mostly sand and clay with very little gravel, blue clay at 12' and water 10-12 feet.

Section 24 (NWSE) Twp. 153 Rg. 79 S. of Falsen Plot No. 12

25 samples taken, 25 assays completed.
Hole 21, 10'-18' .005oz/t. $9.17. Hole 21, 0'-10', and 26'-31' traces; Hole 5, 5'-10', trace. The value was found in sand and the traces in sand, clay and gravel. Located on same chain of lakes mentioned in summary of plot 8.

Section 31 Twp. 153, Rg. 79 (SENW) Near Velva S. of Souris River Plot 13

95 samples taken, 39 assays completed.
11 traces from Holes, 1, 11, 13, 15, 21, 23, 25. This plot is located on a stream that flows into the Souris River above Velva.

Section 28 (SWNW) Twp. 154 Rg. 78 S.E. Simcoe Plot No.21

88 samples taken, 29 assays completed.
Hole 1, 48-8', .06 oz/t. $2.10. This plot is located on the south side of the Souris River at a point 11 or 12 miles northeast of Velva in the locality where the valley of the Mouse begins to widen out and formaa wide level flood plain. This is approximately the location of the last delta deposit of material brought into old Glacial Lake Souris by the Souris River.

Section 16 (SESE) Twp. 154 Rg. 78 S.E. Simcoe Plot No. 20

98 samples taken, 30 assays completed. 4 traces from Holes 1, 5 0'-10'. This plot is similar in location to plot 21 above.

Section 20 (SWSW) Twp. 154 Rg. 81 S. E. Logan Plot No.22

20 samples were taken, 20 assays were completed.
All samples in Pit 4 to 228 carried traces. All samples in Pit 5 to 12' carried traces. Material sand and coarse gravel. Water at 22'. Brand farm.

Section 29 (SWMW) Twp. Rg. 81 S. E. Logan Plot No. 23

28 samples taken, 28 assays completed.
Pits 1,2,3,4,5,6,7,8,9,10 all carried traces from the surface to an average depth of 11 feet. 23 traces. No values were reported on beads representing less than .01 oz/t. so that it is probable that some of these traces represent values ranging from $0.10 to 0.35 per ton. An average section of material would be about as follows: 08-58 loam and gravel, 58-198 gravel, 9'-11' clay and sand. Water at 11'. The pits were arranged in two parallel lines across the southeast corner of the 40 acres. Parallelling the pits is a ridge of gravel and coarse boulders that stretches for miles along the old valley floor. Hand pits had to be resorted to because of the coarseness of the material and the size of the boulders Brand farm.

Section 30 (NESE) Twp. 154 Rg. 81 S. E. Logan Plot No.24

40 samples were taken, 40 assays completed.
Pits 1,2,3,4,5,6,7,8,9 all showed traces or values. 20 traces values ranging from $0.09 to $1.23. An assay sheet showing all holes and samples is attached. The pits were all dug behind the granary on the sloping bank of the present Mouse River. Pits 1,2,3,4 and 5 are sunk on the upper rim of the bank and extend from 3 to 6 feet below top. Pits 6,7, and 8 are located on the slope and are successively lower in the order listed. Although these last named pits are only 5 to 6 ft. in depth they represent a total depth of the deposit or bank ranging from o' to 18' or 20'.

A. Section of material encountered would probably consist of:

1. A rather thin veneer of glacial drift ranging from fine clay and sand to coarse gravel and rocks varying from a few inches to 6' or 8'.

2. Below this and more or less bedded or stratified material was encountered which consisted of coarse red sand bearing large amounts of hematite and limonite or bedded gravel with varying amounts of iron oxide.

3. A thick formation generally consisting of either fine sandy clay, clayey sand, or soft thinly laminated sandstone. Thickness 3' to 6'.

4. Under this layer were alternating layers of fine and coarse gravel, a few inches to several feet in thickness. Iron oxides are present in varying amounts.

5. Under these alternate layers of fine and coarse material, a slightly dipping level of hard blue calcareous sandstone. This bed was not passed through and the thickness not ascertained.

This particular plot is located on the old valley floor of the Glacial River Souris, and the holes were sunk in approximately the center portion of the valleyl The valley at this point is approximately 125 to 150 deep and more than a mile across. During glacial time a great river filled this valley and carried a heavy load of drift material in its rushing waters. The material or a proportion of it was laid along the bed or the valley floor and thus a series of stratified beds, river formed, were laid. Along the top of the valley floor may be seen a thin strip of glacial boulders covering a width of from 50 to 100 feet or more, parallelling the present channel of the Souris. The boulders vary from small pebbles to a size of several feet or more in diameter and are so thick that they resemble "cobble stones".

In the preliminary work material was panned from near the surface and in most cases free gold was observed in the concentrated pannings, in the form often spoken of as "colors". These colors vary in size from that of a pin point to a pin head in most cases though occasionally a larger one is found. Material taken from pits 1, 2, 3 and 6 seemed to yield best results by panning, the layers from 0' to 4' being most consistent. Pannings were assayed as follows:

1. Pannings after the removal of all visible free gold particles assayed 0.102 oz. of gold per ton, equivalent to $3.57.

2. Pannings from which no free gold particles were removed, assayed 0.36 oz. gold per ton equivalent to $12.60 per ton.

This includes all of the data that is available on the plot at the present time. It is planned to concentrate portions or combinations of samples from these pits for assay. Values established in this manner may be distributed back over the original heads and thus stated accurately to within a cent or two of their actual value. Brand Farm.

<u>Section 32 (NENW) Twp. 154 Rg. 81</u> <u>S. E. Logan</u> <u>Plot No. 25</u>

48 samples taken, 48 samples assayed.
27 traces, no values, reported.
Three rows of six holes each were laid out on 100' centers covering a long narrow ridge or knoll. The plot is located a short distance from the present bank of the Souris River about 100 or 50 yards to the northeast. The material encountered consisted of beds of coarse gravel and sand from surface to about 16'. At this latter depth a bed of rock, sandstone or shale was encountered, where the work stopped. Because of the extreme coarseness of the material it was necessary to resort to sinking holes by means of hand pits. Holes 0, 0-R, 0-L, carried traces consistently from surface to bed rock ranging from 12 to 1S'. Hole 1-L carried traces to bed rock at 14'. Hole 3, 3-R, 3-L all carried traces in all samples, to bottom ranging from 10' to 17'. Hole 5, 5-R, 5-L carried traces inall samples, to bottom of holes.

<u>Section 32 (SESE) Twp. 155 Rg. 75</u> <u>S. E. Towner</u> <u>Plot No. 26</u>

100 samples taken, 75 assayed completed. 11 traces 1 value $1.32. Samples from Holes 5, 13, 25 carried traces. On hole 21 a trace was found to extend from surface to 16'. At 16'-18' sample carried .0371 oz. equivalent to $1.32. The plot is located in a district of low morainal hills.

<u>Section 33 (SESE) Twp. 155 Rg. 75</u> <u>S. E. Towner</u> <u>Plot No.27</u>

75 samples taken, 75 assayed. 15 traces from holes 3,4,5,6,7,10,12,15,16,18,21,23. The deposit is similar to that described uner plot 26 above.

3

Section 30 (NWSE) Twp. 155 Rg. 77 S.W. Towner Plot No. 30

81 samples taken, 28 samples assayed.
Hole 25, samples 1 and 2, 0'-12' carried .02 oz/t, $0.70, samples 3 and 4, 12'-22' carried .087 oz/t. $0.30. Plot located on the Eaton Ranch not far from the Souris River.

Section 31 (SENW) Twp. Rg. 76 S.W. Towner Plot No. 40

51 samples taken, 18 assayed 3 traces, 4 values $0.17 to $1.75.
Hole 1, 4'-8' .005 oz/t $0.17, Hole 3, 0'-4' .05 oz/t $1.75 Hole 5, 8'-12' $.17 Hole 15, 0'-4' $0.17, Hole 21, 0'-4', trace, Hole 25, 0'-4', trace. The plot is located on the north side of the Souris River.

Section 5 (NWNE) Twp. 156 Rg. 78 N.W. Denbeigh Plot No. 44

97 samples taken, 43 assayed. No traces, 2 values
Hole 21, 0'-3' carried .005 oz/t $.17, Hole 5, 0'-3' carried .008 oz/t $0.28

Section 24 (SWSW) Twp. 155 Rg. 78 N. Denbeigh Plot No. 47

38 samples taken, 38 assayed. 1 trace, 1 value
Hole 5, 8'-12' .01 oz/t $0.35; Hole 3, 0'-4', trace.

Section 11 (SWNW) Twp 156 Rg. 79 N. Towner Plot No. 48

73 samples taken, 21 assayed. 1 value
Hole 25, 5'-10' .02 oz/t, $0.70

Section 7 (SENE) Twp. 157 Rg. 75 N. Towner Plot No. 51

66 samples taken, 31 assayed
Hole 2, 0'-4', $.09, 4'-8' $.09 Special sample $0.09

Section 24 (NWSW) Twp 157 Rg. 76 N. Towner Plot No. 57

89 samples taken, 30 assayed
Hole 11, 0'4' carried .02 oz/t, $0.70

Section 22 (SESE) Twp. 158 Rg. 76 N. W. Towner Plot No. 64

71 samples taken, 30 assayed
Hole 1, 0'-5', o.008 oz/t, $0.28, 5'-8', .008 oz/t $0.28, 34'-39', .008 oz/t $0.28

Section 16 (NENE) Twp. 153 Rg. 75 N. Round Lake Plot No.7

66 samples taken, 25 assayed, 6 traces, no values
Traces found in Holes 1, 5, 11, 21 at scattered depths.
Plot is located about 20 miles southeast of Towner on low and flat ground. The water table is about 9 feet below the surface. The deposit consists of beds of sand interbedded with clay to a depth of 17 feet at which the deposit is all clay.

General Summary

In general traces or values were found in virtually all types of deposit or material. These types of deposit may be grouped as: Deposits in flat bottom areas of Old Glacial Lake Souris, deposits along the Souris or its tributaries on the low flat flood plain within the Lake Souris Basin; and deposits found in the deep and wide valley of the Souris River from Minot to a point about 12 miles northeast of Velva.

Assay results thus far obtained from plots representing these four types of deposit indicate that although occasional values and traces are found in the first three types named, nothing indicating the presence of values in commercial quanities in these types of deposits. The fourth type, that of deposits in the wide and deep valley of the Souris river, and represented by plots 22, 23,24, 25 southeast of Logan on the Brand Farm and also by plots 20, 21, 12 miles northeast of Velva, located at a point where the valley begins to widen out; indicate the possibilities of occurrence of gold in commercial quantities along the floor of the Glacial River Souris and at a point where it widens out to form a delta deposit. No work has been done in this deposit north of Logan. It seems that the valleys of both the Souris and Des Lacs should be prospected thoroughly from the delta of the Souris to the International boundary.

Assay Report

Section 30, Twp. 154, Rg. 81   J. J. Brand Farm, SE of Logan

Pit No.	Sample No.	Depth	Character	Au.Oz/t.	Au.$/t	($35 oz.)
1	1	1'-3'	under $\frac{1}{4}$"	0.015	$0.52	
1	2	3'-5'	"	trace		
1	3	5'-6'	"	trace		
1	1	1'-3'	over $\frac{1}{4}$"	trace		
1	2	3'-5'	"	trace		
1	3	5'-6'	"	trace		
2	1	0'-2'	under $\frac{1}{4}$"	0.015	0.52	
2	2	0'-2'	"	0.0075	0.26	
2	1	0'-2'	over $\frac{1}{4}$"	0.005	0.17	
2	2	2'-4'	"	trace		
3	1	0'-2'	under $\frac{1}{4}$"	trace		
3	2	2'-3'	"	0.0025	0.09	
3	1	0'-2'	over $\frac{1}{4}$"	trace		
3	2	2'-3'	"	0.0025	0.09	
4	1	o'-2'	under $\frac{1}{4}$"	nil		
4	2	2'-4'	"	nil		
4	3	4'-5'	"	nil		
4	2	2'-4'	over $\frac{1}{4}$"	trace		
4	3	4'-5'	"	nil		
5	1	0'-2'	under $\frac{1}{4}$"	0.01	0.35	
5	2	2'-6'	"	trace		
5	1	0'-2'	over $\frac{1}{4}$"	trace		
5	2	2'-6'	"	nil		
6	1	0'-2'	under $\frac{1}{4}$"	nil		
6	2	2'-4'	"	0.035	1.23	
6	3	4'-6'	"	nil		
6	1	0'-2'	over $\frac{1}{4}$"	nil		
6	2	2'-4'	"	trace		
6	3	4'-6'	"	nil		
7	1	0'-2'	under $\frac{1}{4}$"	0.0075	0.26	
7	2	2'-4'	"	trace		
7	3	4'-6'	"	trace		
7	4	6'-7'	"	0.0075	0.26	
7	1	0'-2'	over $\frac{1}{4}$"	0.0075	0.26	
7	2	2'-4'	"	trace		
7	3	4'-6'	"	trace		

Pit No.	Sample No.	Depth	Character	Au.oz/t.	Au. $/t. ($35 per oz)
8	1	0'-3'	Under $\frac{1}{4}$"	0.0125	0.44
8	2	3'-5'	"	trace	
8	1	0'-3'	over $\frac{1}{4}$"	trace	
9	1	0'-3'	under $\frac{1}{4}$"	trace	

Recommendations

Laboratory Work

1. That assay of samples be completed on all of the 72 plots on 660' center s. (This could be accomplished by April 1, 1935).

2. That all samples showing values or a large number of traces, be concentrated by gravity methods, and their values re-calculated on this basis.

3. That a general microscppic examination be made in connection with the concentration tests.

Field Work

1. That future field investigation include a thorough prospecting of the areas included by the valley of the Glacial River Souris, the valley of the Glacial River Des Lacs, and the three outlet districts of Lake Souris located in North Dakota.

2. That the prospecting of the above areas be carried out by means of pits or bore holes taken at locations most favorable for previous concentration by stream action; and that values be first established in the field by use of the pan, long tom, or short sluice, and then supplemented by assays made in the laboratory, on both concentrated and unconcentrated material from these localities.

3. The following areas be prospected and examined as thoroughly as possible:

    1. The district extending from a point northeast of Velva, N.Dak. where the valley of the Souris begins to widen out forming a wide flood plain, north along the valley to the Brand Farm near Logan, N. Dak., and thence north along the valley to the International boundary.

    2. The district indluded in the valley of the Glacial River Des Lacs, from a point where it joins the Souris, north to the International Boundary.

If time permits while the above work is going on or after it may be accomplished, similar work to be done in the following areas:

3. The district included in the first outlet of Glacial Lake Souris by way of the Wintering River and to the Missouri.

4. The districts included in the second and third outlets of Glacial Lake Souris by way of the Big Coulee, the James River and the Sheyenne River.