REPORT

ON

GEOLOGY,

AND

Plan for a Geological Survey

OF THE

STATE OF MINNESOTA.

MADE IN ACCORDANCE WITH A CONCURRENT RESOLUTION, PASSED BY THE SECOND LEGISLATURE OF MINNESOTA, MARCH 10TH, 1860.

CHARLES L. ANDERSON & THOMAS CLARK, COMMISSIONERS.

TWO THOUSAND COPIES ORDERED PRINTED.

SAINT PAUL.
WM. R. MARSHALL, INCIDENTAL PRINTER.
1861.

REPORT

ON

GEOLOGY,

AND

Plan for a Geological Survey

OF THE

STATE OF MINNESOTA.

MADE IN ACCORDANCE WITH A CONCURRENT RESOLUTION, PASSED BY THE SECOND LEGISLATURE OF MINNESOTA, MARCH 10TH, 1860.

CHARLES L. ANDERSON & THOMAS CLARK, COMMISSIONERS.

TWO THOUSAND COPIES ORDERED PRINTED.

Saint Paul:

WM. R. MARSHALL, INCIDENTAL PRINTER.

1861.

To the Legislature of the State of Minnesota:

The undersigned Commissioners, appointed by a concurrent resolution of the last Legislature, to present a Report on the subject of Geology, and a Plan for a Geological Survey of the State, to your honorable body, have the honor herewith to submit the same.

Respectfully, &c.,

C. L. ANDERSON,

THOS. CLARK.

St. Paul, Minn., Jan. 25th, 1861.

GENERAL GEOLOGICAL FEATURES OF MINNESOTA.

Granite and Metamorphic Rocks.— An extensive range of the primitive system of rocks is found in the north eastern part of our State. Commencing in Canada these exposures stretch along the north shore of Lake Superior and entering our State, constitute what might be termed mountain ranges. The general trend of these ranges is from the north-east to the south-west. They cross the Mississippi River at Sauk Rapids and again appear on the Minnesota River about the mouth of Red Wood River. Although sometimes termed a mountain by Geologists the elevation of the highest of these ranges does not exceed 2,000 feet above tide water. The breadth of this Granitic region is out of proportion to its elevation—considering it as a mountain—being about 60 or 70 miles. But its Botanical and Geological characteristics entitle it to be called a mountain district. Here are found many plants peculiar only to Alpine regions. Here are also found nearly all varieties of the Granitic and Metamorphic rocks.

This region, described so well by Dr. Owen and other geologists, in its general features, is one of no small importance to the resources of our State. Particular observations, which have as yet been but little practised, will undoubtedly bring to light many valuable facts. Copper, silver and iron have already been noted to a considerable extent about Lake Superior, yet we have good reason to infer that in comparison but little is known of the mineral wealth contained in these mountain ranges. Among the Metamorphic rocks overlying, and at times confused with the Granitic, valuable material for purposes of art will undoubtedly be developed,—such as slates, crystalline limestones, soapstones, serpentine, etc.

The region of these primitive rocks--(their actual exposure)—does not cover a very extensive country—consequently the agricultural resources are not materially affected except over comparatively a small surface.

Even in the region where these rocks are exposed the soil of the little valleys is rich. Yet the mineral productions will more than compensate for the agricultural defects.

Lower Silurian Rocks.—Perhaps the lowest, or oldest fossil-bearing rocks in the world are found in Minnesota. Hugh Miller says, "America is emphatically the *Old* World." He means in a geological sense. If this is the case, the fossils found in the Lower Sandstone are certainly the oldest vestiges of creation. The Silurian rocks, according to Dr. Owen's nomenclature, (which I esteem as the best,) may be considered as follows, proceeding from the primitive rocks upwards:

1. Lower Sandstone.
2. Lower Magnesian Limestone.
3. White Sandstone.
4. Shell, or Blue Limestone.
5. Upper Magnesian Limestone.

Each of these natural divisions I propose to notice briefly. Not that I have much that is new or undiscovered in regard to them, but more for the sake of calling attention to what may be their economical importance.

1. *The Lower Sandstone.*—This covers a large area of our State. In all probability it extends northward to Lake Superior where it forms the long disputed "Red Sandstones" of that region. If such is the case, (and I think there are proofs which in addition to what Dr. Owen has presented sufficiently establish this fact,) these Red Sandstones of Lake Superior are really the very lowest members of the Lower Silurian. That fossils should be exceedingly scarce in these rocks is not wonderful. If they ever existed, and they probably did, the heat, and other chemical agents, and disturbing causes to which they have been subjected has changed them in character to such an extent that they appear almost like another formation of a different age.

The Lower Sandstone is highly fossiliferous—containing Lingulas, Orbiculas, Trilabites, Crinoidea, Orthis and one species of the Obolus. Its palæontology therefore is highly important.

Lead, I believe, has not as yet been discovered in this Sandstone. But copper ore to a considerable extent has been taken out of it.

This formation is deserving of careful investigation in all parts of our State whenever it appears as a surface rock. As well on account of its containing the first types of organic beings, as of its mineral value. If as Dr. Owen suggests, the Red Sandstones of Lake Superior, and the Lower Sandstone of the Mississippi River are of the same age; "it must be admitted," to use his words, "to favor the view that they are of the same age of the Red Sandstones of Virginia, Maryland, New Jersey, Connecticut and Nova Scotia." This being once proven beyond a doubt, will lead to a vastly important practical matter. It will serve to guide the mi-

ner in his explorations after mineral wealth and will save him, many times, a needless expenditure of toil and money. These Sandstones of Virginia, etc., have generally heretofore been conceded as belonging to a period subsequent to the Carboniferous era. But if Dr. Owen's views are correct in none of the regions where these red sandstones occur, need search be made for Coal, or any of its associates, underlying them. They belong to the Lower Silurian date.

I have spoken of the Lower Sandstone as containing the earliest types of organic beings. Its age is equivalent to the Potsdam Sandstone, of New York—for a long time considered the oldest fossil bearing rock in the United States, if not in the world. The lower series of the Lower Sandstone in Minnesota in which fossils are found is perhaps of a still older date. A development of its pataeontology is therefore highly important in a scientific point of view. And I may add that as a general thing whatever encourages and advances science, however distant apparently, from anything practical, will in the end be of the highest practical value.

2. *Lower Magnesian Limestone.*—This is the most prominent rock in the southern part of our State. The majestic and beautiful scenery between St. Paul and Prairie du Chien is mainly formed by the Lower Magnesian.

To what extent this formation is valuable for purposes of art, and for its mineral contents is but imperfectly known as yet. Lead and Copper ores have both been found in it. As a general thing it is more favorably situated for the retention of mineral ores than the Upper Magnesian, which is so rich in lead. I have but little doubt from the descriptions already given of it by Dr. Owen, and others, that a thorough exploration would lead to the detection of a greater quantity of minerals than is at present presumed to exist there.

The fossils of the Lower Magnesian are by no means numerous, or easy of determination. Dr. Owen succeeded in identifying several species—of which he mentions a Lingula, three species of Trilobites, a Terebratula, an Orthoceras, a new species of Straporollus, two species of Pleurotomaria, and a Murchisonia.

The soil derived from this rock is generally of an excellent quality—being durable and quick, and well suited for nearly all kinds of crops. Experiment, however, in middle and Southern Minnesota proves this remark to be highly gratuitous.

3. *White Sandstone.*—This is sometimes called the Upper White, or St. Peter's Sandstone. It is almost *pure silex* or *quartz*. There is but a trace of alumina and carbonate of lime in it, scarcely enough to interfere with its use in any of the arts. It has been but sparingly tested in the manufacture of glass; but treated in the same way as the "Linn Sand,"

by Dr. Owen, it produced a glass of similar quality. Compared with sand from Lanesboro', Mass., from which beautiful glass is made, I can discover no difference in the purity of the grains. I speak more particularly of the purer beds, of which there is an abundance in the vicinity of Fort Snelling. Some of the beds contain traces of iron.

To what extent this sandstone may be valuable, remains for experiment to solve. A pure Silex in such inexhaustible beds, in such a state of fineness, cannot help becoming a resource of immense value in the course of time.

As yet no organic remains have been found in it.

It is also devoid of minerals of any consequence. Mr. A. Godfrey, near Minnehaha Falls, however, has shown me some fine nudules of Bi sulphuret of Iron, (Iron Pyrites,) which he found in the sandstone near his house. These, if found in large quantities, would prove valuable.

4. *Shell*, or *Blue Limestone*.—This is the Limestone at St. Paul, and at the Falls of St. Anthony. It has been pretty well tested for architectural purposes at these places, and also at Fort Snelling. A careful selection is necessary, in order to get a durable material out of it. The quantity of lime it contains is not sufficient to render it very valuable for burning. However, there are some localities where it is said to be equal in that respect to the Alton Lime. I have seen such an one near the town of Faribault, in Rice County.

From some experiments already made, this Limestone promises to furnish an excellent *Hydraulic Cement*. Ultimate success in this will be a matter of high importance to our State. From an analysis made by Dr. Norwood of the middle section of this Limestone, I have been enabled to compare it with the analyses of numerous hydraulic limestones in different parts of the United States, with the satisfactory inference that it is well suited for hydraulic purposes. It only lacks the necessary experiments to verify, as I think, the truth of my conclusion.

I am not aware that minerals have ever been discovered of any value in this limestone.

It is replete with fossils, which indicate its age to be equivalent to the Black River and Trenton Limestone of N. Y., and in part, to the Blue Limestone of Ohio. Most of its fossils are familiar to Geologists; yet there are some species new and undetermined. These yet may be of importance to the palaeontologist. Its distinguishing fossil is the Leptæna—some 15 species of which occur in it. Orthoceratites are exceedingly common, and the species numerous. Some of them are of an enormous size, measuring 9 or 10 feet in length!

As to its durability for building purposes, much depends on the selection. If some of the lowest beds should be taken out of the quarry, dressed,

and immediately put up, they would last uninjured for a great many years. I have noticed blocks, or slabs, in the Cemetery at Fort Snelling, which have lain exposed to the weather for 25 or 30 years, without the least injury to the integrity of the stone.

Dr. Owen has classed the *Shell Limestone* with the Upper Magnesian. Its palæontology seems to warrant this. The distinguishing line between the two is not difficult to find; yet the beds above and below the lime are very similar in composition and other lithological characters.

5. *Upper Magnesian Limestone.*—This formation is almost if not entirely wanting in this State. It is the lead bearing rock in Wisconsin and Illinois, and has a very close resemblance to the Lower Magnesian in most of its lithological features. It probably occurs in the higher bluffs in some of the middle Southern Counties, on a line between Mankato and Root River Valley.

Its palæontological and mineralogical characteristics have been well discussed in the Geological Reports of Wisconsin, Illinois and Iowa.

This concludes the rocks of a Silurian date in Minnesota. From the Upper Magnesian there is a wide gap in the Geological scale. No other formations are found until we reach the Quaternary or Drift period. I may except, perhaps, some slight beds of the Carboniferous, Cretaceous, and Tertiary, which probably will be found in the Southwestern part of the State. Of this, however, there is much uncertainty. The idea of finding beds of coal of some value, should not be entirely abandoned. If the Cretaceous formation should be found to exist, there are still hopes that on its Eastern border may be found detached beds of coal.

Quaternary or Recent Formations—Marl, clay, sand, peat, &c., exist to a large extent. Not enough however, is known of the extent and value of each to say much about them.

Iron is found everywhere in the Drift, and it is probable that some clay beds may be discovered of much value. There are many localities where surveyors have had great difficulty in running correct lines, on account of its influence on the needle. As yet nothing very definite is known in our State as to the most valuable deposits of this ore.

Fossil remains in the Drift, as yet, have not been found to any considerable extent. At Stillwater, the remains of two skeletons of the mastodon species, (mastodon giganteus) were discovered in the sand and gravel drift, overlooking the town, a few years ago. I have seen several fossils belonging to the Cretaceous and Eocene Tertiary, that I was told had been found in the drift, in the central part of our State. These may have been drifted across from Dacota, west of Red River. We have found also numerous pieces of Lignite that undoubtedly have been brought from some beds on the western borders of our Silurian rocks. They are all water-worn, showing that they have been transported a considerable dis-

tance. One piece found near Minneapolis, in digging a well, would weigh 15 or 20 lbs. Externally it resembled a dark colored boulder, and might have been taken for such without a close examination.

In regard to the *soil* there is so much that might be said with advantage, that in this limited Report, it is hardly possible to say anything that ought to be said. I will, therefore, pass it, by merely referring any one for information on that subject (as well as most other things connected with the interests of our State) to the *First Annual Report* of Joseph A. Wheelock, Commissioner of Statistics. The physical geography, the climate, the soil; and, in fact, nearly all the *known* resources and features of our State, are there ably discussed and pointed out. I could add little or nothing to what he has said.

Agriculture in Minnesota, has made rapid strides within the last three years. The capacity of our soil is being well tested, and its resources well developed. What remains to be done is to stimulate by scientific investigations a development of our hidden resources. And to that end I propose the accompanying *Plan for a Geological Survey*. At the same time adding such remarks as I have deemed relevant.

PLAN OF A GEOLOGICAL SURVEY.

1st. The appointment of a competent Geologist, who should have full control and bear the whole responsibility of the survey, for a term of not less than three years, and with a salary sufficient to enable him to proceed in his investigations, bearing his own expenses throughout the State, without needless embarrassment on that account. The least sum possible to enable him to work continuously, and engage at times such help as would be absolutely necessary, would be twenty-five hundred dollars per annum.

His duty should be to enter into a full and scientific examination and description of the rocks, minerals, soils, salt springs, fossils, sands, marls, clays, and, in short, everything pertaining to the Geology and Mineralogy of the State. Also to collect, as is now required by law, for the cabinet of the State University, a complete set, so far as possible, of such specimens in Natural History, Geology and Mineralogy, as shall represent the resources of our State. He should prepare the results of his labors and observations for publication, under the following heads:

1. Physical Geography, Scientific Geology, and Mineralogy.
2. Economical Geology, Botany and Agriculture.
3. General Geology of the State.
4. Such contributions of Meteorological observations as may be made in this State.

2nd. As often as sufficient facts and materials shall have been collected upon the above named subjects, or any one or more of them, to form a volume of not less than 250 pages, octavo, the State Geologist should make a report thereof to the Governor of the State, with an estimate of the probable cost of engraving and publication. Whereupon the Governor approving, shall cause to be issued by the Secretary of State, a circular to the printers and engravers within the State, specifying the work, amount of engraving, and style of binding, and number of copies required, and the period within which said work shall be completed, asking proposals to publish the same, and fixing a time when such proposals shall be considered, and the work awarded to the lowest and best bidder, having due regard to his or their ability, skill and responsibility. The Governor should take a bond from the

person or persons whose bid is accepted, conditioned upon the faithful performance of the work, in a sum not less than double the cost of the work.

So soon as the Governor shall have ascertained the probable cost of the volume to be published, and the price at which it may be sold without loss to the State, he should cause it to be advertised to receive subscriptions for the same by volumes—the prospectus of the same having been issued by the publisher or contractor, and the number of volumes to be published should be sufficient to cover such subscription, in addition to the number ordered by the Governor under the contract and no more. Provided, however, that the Governor may grant the copyright of the work to such publisher, upon such terms as he shall deem for the best interest of the State; reserving for the use of the State such number of volumes as may be ordered from time to time by the Legislature; and the subscriptions which may have been made for the work shall be supplied by the publisher at the same price which had been stipulated in the prospectus. If this provision cannot be made available, the Governor should cause the publications to be sold to the subscribers or others, at the established price as provided above; and the proceeds of such sales should be paid into the treasury of the State.

3rd. The State Geologist should so annually distribute his researches in the different parts of the State as may tend to the development of a portion of each. He might, at his discretion, make examination for individuals or companies; but the result of such examinations should be incorporated in the publications.

4th. It should be the duty of the State Geologist annually, at the commencement of the annual session of the Legislature, to make report thereto, of the cost of the survey during the preceding year, together with an estimate for the succeeding year.

5th. The State Geologist should so arrange his labors and researches as the survey progresses, that in case of his death, or removal from the work from any cause, a competent Geologist might continue the same, and thus save loss to the State.

REMARKS.

Whoever undertakes to build a house should sit down and carefully study, to secure the best plan. Many things must be taken into the account. In the first place, the *building site* should be well considered, that he may select a plan to correspond with it. In the second place, the *main objects* to be attained in the structure are of vital importance to his plan. In the third place, the *kind of material* to be used. In the fourth place, the *practical experience* of architects who have erected buildings before him, thus enabling him to combine experience, which is a valuable kind of knowledge, with his theory—both of which must be made to harmonize if possible. And in the last, but not the least place, he should "count the cost," so as not to *fail* before he completes his structure.

1. In the Report on the *General Geological Features of our State*, we have tried to enforce upon your attention the grand and important physical structure on which the survey is to be made. It is by no means meagre in resources. From the little already seen, there is promise of a rich development in the future. And the sooner this richness is made available, the sooner will our State be enabled to become independent of financial embarrassments.

2. The *objects* of a Geological Survey may be stated very briefly as follows: It consists in placing before the people of the State in the most available and intelligible form, all the information that can be obtained in regard to the rocks, minerals and soils. Also, to this might be added information, especially of a practical character, in regard to the vegetables and animals peculiar to our State.

3. Whatever part of the survey is undertaken and reported on, should be of the most *substantial* kind. All that is possible for human knowledge to accomplish should be accomplished. There should be no s ighting of the work—no necessity for tearing down and building up again.

4. There is a vast accumulation of *experience* before us. We have the history of surveys in other States. If we are wise we can profit by what has been in many instances their loss. We can see where they have made

gross mistakes in the management of their affairs. It would be useless to enumerate their errors. One, however, that I would not be doing my duty to pass in silence, is that of allowing *party prejudices* to interfere in any manner with a survey of this kind. I might mention some of our neighboring States that have had sad experience in this respect. But that would be personal and might give offence. I may be permitted to say, however, that rewarding a political leader with the office of State Geologist, and a liberal yearly salary, when he is totally incompetent for the task, is a thing that *has been*, but I trust *will not be again*.

5. As to the *cost* of such a survey, the strictest economy, consistent with the attainment of the object sought should be rigidly pursued. If such were the course adopted, after the first year, the survey, instead of being an expense, would be remunerative—at least indirectly so. Attention would be called to our mineral resources—and the erection of manufactories—it may be for iron, copper, or lead—would soon engage the attention of capitalists, and an inflow of population would be the result—more than enough to repay the State the small appropriation made each year for the survey. But let us look at the subject in a more general way;

When we reflect on the amount of money that goes out of our State each year for articles, that with a little encouragement might just as well be manufactured at home, it is no wonder that we hear so continuously the cry of "hard times." With as good iron ore as the world can produce, the United States still imports three million dollars worth of that article—Minnesota receiving her share. Copper is sent from Lake Superior to England, there to be manufactured, and returned to us at a cost of more than two hundred per cent. With a deposite of coal in North America twenty times the area of all the known deposites of the Eastern Continent; and almost thirty-five times as large an area in the United States, as Great Britain's coal area; yet the Atlantic cities import annually 285,869 tons. And all these things because our home resources are not opened up, and because there is not sufficient encouragement to our own enterprise. What might be said of the United States—or any one of the States—in this respect, might also be said of Minnesota.

So much in regard to "counting the cost." Instead of the survey, if properly conducted, running the State in debt it will be a means, most potent, in relieving her of financial embarrassment, and causing a feeling of independence—in being able to exist by her own internal richness.

Little, comparatively, is known of our Geology. Dr. Dale Owen has given in his official "Report of a Geological Survey of Wisconsin, Iowa, and Minnesota," nearly all the facts that have been published. His researches, so far as they went, are of the most reliable kind. But his reconnoissance was distributed over an extent of country four times as large

as the State of New York—consequently there was but little time to explore or investigate any one locality. It will therefore be a long and arduous task, but nevertheless immensely valuable to our State to develope what is still unexplored.

[NOTE.—That part of the Report which follows was prepared by my associate, the Hon. Thos. Clark of Beaver Bay, Lake Superior. I have thought best not to change it—but to present it as prepared by him. It contains many valuable and original facts and suggestions, in regard especially to a very important part of our State. C. L. ANDERSON.]

REPORT OF MR. CLARK.

To Charles L. Anderson, M. D.

After perusing the manuscript you have prepared for submission to the Legislature, little can be added upon the subject in my estimation that will interest a reader. I, however, offer the following for your consideration and submission:

The observations embodied were made during the last six years, in which time I have made six overland trips between the Mississippi, St. Croix and Lake Superior, surveyed three routes for railways from these rivers to the Lake, and one from the west end of the Lake to Bayfield, coasted the Minnesota shore of the Lake, made several trips interior, and one across the northeastern portion of the State to the northern "boundary" or Rainy Lake Valley.

The information sought, was the practicability of settling the country, its resources, and feasibility of internal improvement.

By climate, as that eminent physicist, the Baron Von Humboldt says, we understand "all those states and changes of atmosphere which sensibly affect our organs, temperature, humidity, variation of barometric pressure, a calm state of the air, or effects of different winds, the amount of electric tension, the purity of the atmosphere, or its admixture with more or less deleterious exhalations, and lastly, the degree of habitual transparency of the air and serenity of the sky, which has an important influence, not only on the organic development of plants and the ripening of fruits, but also on the feelings and whole mental disposition of man."

The system of meteorological observations instituted under the direction of Professor Henry, and annually published, illustrates the climate of the belt including this State. There are eight or ten observers in this State who report to the Smithsonian Institute—and though annually published, we are yet often accused of inhabiting *a cold region in the north*. A perusal of those records will satisfy the student of two facts. *First*—That this State, in temperature, ranks with New England, New York, Michigan, Wisconsin, and compares favorably with Pennsylvania, Ohio, Indiana, Il-

linois and Iowa; and *second*—that the northern portion of the State enjoys a more equable climate than the prairie districts.

The numerous lakes distributed throughout the State acquire a high temperature during the summer, and retaining it late in autumn, check the effect of early frosts. In the fall of 1859, after several frosts had occurred, I could discover no effects about the "boundary" lakes. At Sandy Lake, in September, 1860, corn and potatoes were untouched after several frosts had occurred. Lake Superior has an area of 41,800 square miles. This State borders on 150 miles of its coast. Its mean depth is 800 feet. Its surface is 600 feet above the surface of the ocean, and its temperature scarcely varies from summer to winter, remaining at from 44° to 46° in the main body. Hence, the *littoral* climate of that region, as appears by the observations compared with more southern localities. Snow commences to fall about the fifteenth of November—before the ground is frozen—in moderate quantities of about four inches a week. This settles to about two. The greatest accumulation was in March, 1859, when it measured in the wood land, forty-four inches, producing four and three-quarter inches of water. It seldom thaws during winter—never sufficiently to expose the ground. Roads remain firm and even. The snow being *dry* is readily swept or removed from walks and roads. During the six winters I have observed, rain has not occurred sufficiently to produce slush. In spring it gradually disappears under the influence of the sun, leaving the ground free of frost and ready for the plow.

The most reliable testimony of the climatic characteristics of a region are its natural trees, plants and fruits, and actual agricultural products.

The sizes of the deciduous trees are less than those recorded of other localities. This is due to climate in some varieties, as Cherry (Cerasus-serotina), and Butternut (Juglans cinerea), and Pignut (Carya glabra). The majority of the trees are thrifty. Their concentric grains count from one hundred to one hundred and fifty. Beneath their roots are the decayed remains of a ruined forest of conifera. Upon the dividing ridge between Lake Superior and Rainy Lake, is an area of a hundred acres or more of what had been a forest of Pine (mostly banksiana and resinosa) as appeared by their remains. This area had been burnt over. Growing upon it, (August, 1859), were Maples (Acersaccharinum), one year old, bright and thrifty, so thickly that we were obliged to "trample" (as my companions said), "upon the sugar-orchard-nursery." The size of our deciduous trees is due rather to their *youth* than our *climate*. In township 36, N., range 22, W., I measured a Butternut—thirty inches diameter—about fifty feet in height; and an Oak (Quercus alba), forty eight inches; diameter, and seventy or eighty feet in height. The latter, in township 49 or 50, N., in the valley of Prarie River, where there is an extensive

forest of White and Bur Oak, a majority of which are *young* trees, from four to ten inches diameter.

Specimens of cultivated plants were noted and observed in August, September and October, 1860. Mr. Sayer (late of England), in charge of Col. R. B. Carlton's farm and garden at Fond du Lac (Superior), had prolific yields of onions (from seed), celery, ten inches blanched; cabbage, firm, large heads; cucumbers, carrots and many other plants. C. Williams, at Twin Lakes, Carlton county, eight miles south of Fond du Lac, harvested his Winter Wheat August 4. White, bald or flinty variety yield 38 bushels to the acre—(soil, sandy clay). A specimen of this wheat was shown Mr. Ford of St. Paul. Wheat, Rye, Oats, Barley, Potatoes and Corn were observed on the farms of Messrs. Shortreed, Sandy Lake, Coffee, Sayer, Carlton, Fond du Lac, Webster, Sargent, Gurno, Keely, Ford, Ely, Wright and others in the valley of the St. Louis, all of fair yield.

Significant of the climate and Nature's care of plants in the provision of snow, may be added, that the Potato receives no injury when left in the *hill* all winter. The spring of 1859 I planted a piece of ground on the farm of Mr. Phillips. (N. shore of Lake Superior), where he had a crop the year before, finding many of the former crop in the ground. They were tried both for seed and food. They were the first to produce new potatoes, and dry and mealy for the table. Wm. Mann, Esq., and I, from the farm of Mr. Sayer, five miles above Fond du Lac, in August, 1860, obtained ripe potatoes, the product of "self-planted ones," or the remains of the previous year's crop.

In the settlement at Beaver Bay (north shore Lake Superior), Hon. W. W. Kingsbury, and I saw Spring Wheat harvested September 18th, 1859. It was planted the 18th June previous. The yield was eighteen bushels. Mr. Teischer had harvested Winter Wheat, yield forty bushels; Winter Barley, yield sixty bushels to the acre. The Messrs. Wielands, intelligent and practical men, formerly from Wurtemburg, (Germany), have introduced several species and varieties of European cereals, esculents and grasses, and their ladies numerous flowering plants, all of which mature as well as in Wurtemburg.

Of fruits, few facts can be noted of cultivated ones. Apples are raised in Minnesota in the first decade of herpolitical existence. More than this cannot be said of older Northern States. The Siberian Crab and common Apple nurseries are doing well. Those under my observation at Superior and Beaver Bay, leaf their upper buds. It is a general rule that where the Plum, (wild red), White Thorn and Wild Rose flourish naturally, the Apple may be successfully cultivated. Mr. Mann, of Superior has the cultivated varities of the White Red and Black Currant all in fruit after the sec-

ond and third year's cultivation. The indigenous berries are plentiful, the gooseberry without prickles is common. The great and abundant supply of fruit in the lake region is the Red Raspberry. It is spontaneous in wind falls and burnt lands, and is made an article of commerce. The Whortleberry is found in isolated localities, pine barrens and burnt lands. The most extensive patch we met with, (August, 1860), was on the Mille Lacs road, town 46, Range 19, W., where Messrs. Payte, Iddings and our companions found an abundance.

The only wind of *force* I have witnessed in Minnesota was in March, 1855. Its range was from the north bearing east. At St. Anthony their Suspension Bridge sustained some injury. Chimney tops were thrown down at St. Paul. I was at Elliota, on the Iowa line. Its force there excited some fears. In the forests we find reliable *records* on this subject. By the growing over of the decayed trees it appears that about the year 1710, a heavy wind passed over a portion of the State. Its course was from west to east. Its central and stronger current was between 46° and 46¼° North Latitude; yet within that belt a large amount of Pine withstood the gale, its age being from 250 to 300 years. In my explorasions and surveys "wind-falls" have been noted. Four well-defined ones exist. The one above described, the other three varying in breadth from twenty to eighty rods. Their courses from the western to the eastern points of compass. One in 46¾° North Latitude, occurred about 1840. One in Latitude 47¼° in 1857. The last, July 10, 1860, not extensive. It crossed the Point Douglas and Lake Superior road in Latitude 46¾°.

Pines bearing lightning tracks, and sometimes shivered to the ground, are met with. These occur, perhaps, as high as one to a township—in age from two to three years. An area of one hundred square miles receives one or two strokes a year.

Could the valuable life of the Baron Von Humboldt have been prolonged, and he visited the State of Minnesota, would he not have said "*the degree of habitual transparency of the air* and the serenity of the sky" of Minnesota has "an important influence not only on the organic development of plants and the ripening of fruits, but also on the feelings and whole mental disposition of man."

The Geologist has no higher duty to perform than to examine the *soil* of his field of observation. From it is derived the sustenance of man. All his searches for gold, iron and minerals are but for their dross when compared to the mine of wealth in the soil. It is composed of the ruins of rocks transported and deposited under the action prevalent of the drift period. The granite basalt and trap boulder and fragment are geological specimens of the original elements of our best soils. Analysis of various metamorphic rocks, as shown by De la Beche, give seven per cent. Potash in Gneiss;

in Talcose Slate, thirteen per cent. Magnesia; in Mica Slate fourteen per cent. Oxide of Iron. These alkalies and minerals in our soils illustrate that, however much is due to climate for our prolific yields, no less is due to our soils, when chemically considered. The soils exhibit the strongest varieties. Where sand predominates, the admixture of clay gives it substance. Where clay predominates, marl and iron oxide enter. Two thirds of my field of observation—the triangle between the St. Croix and Mississippi, and bounded north by the St. Louis and Prairie Rivers—consists of the above soils. The remaining third, distributed in areas of from one hundred to one thousand acres throughout the triangle is "Swamp Land," based upon data from observation I estimate:

Sandy barrens—little timber	122,000 acres.
Cranberry marsh—no timber	256,000 do
Tamarac marsh—Tamarac, Cedar and Spruce	735,000 do
Rice beds	74,000 do
Small lakes	73,000 do
Total	1,250,000 acres.

The elevation of the main or dividing ridge between the St. Croix and Mississippi is known to be from one to two hundred feet higher than those rivers at their approximate points. Hence ample fall exists for the thorough drainage of these lands. Many of their natural products may be improved upon. The Cranberry areas especially. Their drainage may be so arranged that they may be cleared, all other plants and grasses eradicated, and then restocked with good, thrifty vines, care being taken to select the gray fruit variety, as it is more prolific, and withstands the frosts that sometimes occur before the fruit ripens. The drainage might be controllable so that the cultivator could irrigate the vine when his experience taught the proper time. Wild rice, the value of which to the native is no greater than it may be rendered to us. It is probably a biennial. Its greatest yields—in alternate years. It grows from the bed submerged by water, from six to twenty inches. One root has from three to ten stalks and heads. I observed one fact worthy the attention of the civilized cultivator. It is this. Plants upon the margin of rice beds, by the fall of the water left upon the dry ground, were quite as prolific as those in the water. This suggests the drainage of rice beds, clearing them from other aquatic grasses and plants, re-seeding with rice, and then closing the drain or outlet until the grain is near maturity, when the water may be drawn off and the bed left dry for harvest. The Hop, (Humulus lupulus or var?) is found indigenous in the savannahs. Whether this variety (if variety it be), is improved by cultivation or not, its natural growth in our soil is evidence that it or more favorite varieties may be introduced and cultivated on the restored lands.

The study and improved culture of the Cranberry, Rice and Hop plants are worthy of the early attention of our citizens.

The subsoil of these lands is the same as the upland sand, clay and marl. The surface is vegetable mold and fibrous roots nearly a peat in some localities—covered with moss, grass and ferns. The depth of this surface deposition varies from one to three feet. Some of these marshes are of modern origin. Wind falls, beaver dams and luxuriant growth of grasses and plants have obstructed their channels of drainage—drowned the timber which is now seen in the decayed trunks of Oak, Ash, and Pine imbeded—upon which have grown the Tamarac, Spruce and Cedar, and instances are, where the latter have in turn been drowned out. Others were basins in the undulating drift—without outlet—as the sand and clay became compact the basin retained the water. These ponds and small lakes gradually fill with decayed vegetable matter and overgrow with grass, moss and ferns. This description of marshes is deeper than the first, varying from three to six feet. Some have entirely overgrown the original pond, while others have encroached only.

With the abundance of good land that we have, private enterprise will hardly engage in their restoration. Yet in view of their adaptability to useful purposes, may it not be soon that measures be adopted to insure their restoration? Whatever disposition is made of them should secure their drainage. It is a fact well known from observation that these lands have a direct influence in keeping down the temperature of the region impinging upon them. The mosses shield the ice beneath it from the influence of the sun. I have found the peat frozen—or unthawed—as late as June—the water remains cold all summer. On and near them eratic frosts occur nearly every month. In September, 1860, in one of Mr. Shortreed's fields adjoining a marsh, beans and potatoes were frosted, when at the same time those plants as well as corn and cucumbers in another locality remote from marshes, were not effected. It is well authenticated that the temperature of Great Britain has raised one degree, attributed to their drainage during the last fifty years. This adds five days to the number without frost. Every farmer knows the value of a day and night without frost in both spring and fall.

The intrinsic value of these lands as a source of of revenue from the proceeds of their sale, is too remote in the future to be anticipated. Any measure that will induce their drainage and render them productive, will soon give them a taxable valuation. and render them a source of permanent income.

In sections 5, 6, 7, 8, 9 and 10, Township 48, N. Range 17 west, in and near the St. Louis River, is an extensive slate formation. The rocks vary in quality from soft silicco-argillaceous to altered and highly metamorphosed rock. The exposures *strike* East and West, the planes of their cleavage at

an angle of 80° above the Northern horizon. They project above the earth surface from one to thirty feet. The perpendicular thickness of the formation is probably two hundred and fifty feet. The working of these slates will involve none of the risks incident to other mining, as the experienced slate dresser can from the surface exposures select the more fissile and of any degree of hardness desired. The supplying of the Mississippi Valley with this article for roofing of churches, mills, manufactories, grain and warehouses, as well as the better class of farm buildings may be a source of no inconsiderable traffic.

The cost of quarrying and dressing at the Vermont quarries is about $2.50 per square (100f.) or $7.50 per ton. The market value at Chicago is from $5.50 $6 50 per square, or $18 per ton ton. At St. Louis it is *third* class-freight higher.

At Fond du Lac, the red sandstone formation out crops or rather is exposed on the St. Louis River. It is in layers of from one inch to three feet —of various tints and composition—interstratified with shall, mica, argillaceous and iron oxide belts or seams. From one layer—a light brown tint —sharp grit grind-stones have been dressed. For both heavy and light masonry these layers are well adapted.

In Township 49, Range 16 West, is the promontory seen in the distance, up the valley of the St. Louis, from the decks of steamers, as they approach the Minnesota end of Lake Superior. The rock exposed at its summit a green stone—granitic in structure, and valuable for heavy masonry. Down the face of the mountain, the rock becomes amygdaloidal—imperfect crystals perhaps zeolites, with epidote. Here are also found some fair specimens of quartz rock. The view from this promontory amply remunerates the explorer—as my companion, Mr. Payte, and I can testify—for the labor of mounting it. Some years since, Hon. J. A. Markland, gave it the name of Sevastopol Mountain, by which name it is becoming generally known.

From this point commences the rock formation, characteristic of the North shore of Lake Superior, the anticlinal axis of which is parallel with, and generally about five miles interior from the Lake. From the ridge it has a gradual slope to the Lake. This slope is covered with drift, clay and marl intermixed with the debris of the Trap Granite and metamorphic rocks—a full set of specimens would exhibit over six hundred shades and varieties. The action of the streams which traverses this range has cut the rock, leaving mural exposures in some of a hundred feet or more. It is in these gorges that the copper prospecter makes his researches.

Veins may be mistaken for joints, and *vice versa*. They may be open crevices varying in breadth and extent, cut off by faults or joints in the accompanying rock. Miners after tracing, proving, and working them in a

particular district, discover their system and general bearing, and though a vein may contain the desired accompanying crystals, spars, and even copper, unless it conform in other respects with the proper system, it may turn out to be worthless. Still the existence of these false appearances are evidence of the proximity of metal bearing veins, and the persevering miners of Lake Superior are now raising more copper than is produced from the mines of Wales. The field for observation and search in Minnesota has been briefly described, and when critical examinations have been made and the results published, capitalists will take hold of and open the more reliable localities.

Among the localities that deserve particular attention, and which show not only the characteristics of metal bearing veins but the pure copper itself, the following will be found interesting if not valuable.

A quartz vein traversing the metamorphosed slate, in the S. W¼ of Sec. 5, T. 48, R. 17. It is pure white, having at a short distance the appearance of crystal ice, about six feet wide, bearing east and west. This is not mentioned as a metallic bearing vein, but deserves the study of the scientific mineralogist.

In the gorge of the creek that enters the lake about five miles from the head, and traverses Sections 4 and 5, T. 50, R. 13., are exposed several veins that will well reward the examination. Particles of copper appear the vein stone, and many rare crystals.

In Sections 17 and 18, T. 51, R. 12, a vein appears carrying copper, French River, which cuts the formation, has been explored by several experienced miners, and several specimens of copper found.

Carp River which enters the lake in Sec. 19, T. 51, R. 12, exposes several of the better and more reliable veins from which specimens have been taken of a very satisfactory character.

Knife River, in T. 52, N. R. 12, discovers numerous well defined veins. from which every visitor secures a copper specimen.

The streams in T. 53, R. 10, show a variety of interesting formations of spars, epidotes and other crystalline formations, in conjunction with rock usually recognized as mineral bearing.

A collection of specimens from the above as well as almost any other locality on the Lake—including a sufficient section of the adjacent rock to illustrate the characteristics of the veins—and properly arranged for examination and study would be not only instructive but call the attention of capitalists to investigate the merits of our mineral district.

The existence of copper is well known to the natives. They often exhibit mass specimens of several pounds weight—but the locality of the matrix they will not divulge. Thorough and critical examination only will bring those valuable resources to light. Private explorations have been

and are being made, and both copper and iron discovered, but the searcher rewards himself with the secret until he can find *his man.* *

Several localities have been secured by private entry. Still no active preparations have been made to work them. Some have secured them for purposes of speculation. Those who design to open their veins are deterred by the great expense of the first outlay—which is rendered greater from the high price of provisions in that vicinity. During the past year roads have been opened from the Lakes to the frontier of the agricultural districts in the Mississippi and St. Croix Valleys. This will stimulate the opening of these mines. To Minnesota belongs the furnishing of the entire Mississippi valley demand for copper, and the upper portion with iron. Five thousand tons of the former and twenty-five thousand of the latter is estimated as the demand at the ordinary rates of consumption. To Minnesota *belongs* the manufacturing of these crude materials. The waterfalls of the St. Louis, St. Croix and Mississippi will estimate by millions of cubic feet per minute with every facility for converting them to use over falls of from twenty to seventy-five feet. These facilities at St. Anthony are pre-eminent. There for a mile or more on both sides of the river the waters may be led along the upper terraces and used to an incalculable amount. The spirit of enterprise at that locality is active: a flouring

---

* MORRISON COUNTY, February 12th, 1861.

To the Editors of the Press:

To-day I forward by Hon. Levi Wheeler, Representative from the Third District, a few specimens of the mineral wealth of this portion of the State, with the request that he will first exhibit them to the editorial fraternity, as far as convenient, and afterwards deposit them in the proper place at the Capitol, for general examination.

They are unquestionably interesting specimens of native copper, and found, as they have been in connection with a geological formation eminently suggestive of mineral treasures, an interest attaches to them not only for the scientific citizen, but for all who feel an interest in the development of the varied resources of wealth and prosperity, which lie within the limits of our State.

We have but to adopt, as a State, a gradual, safe and progressive policy, not only with regard to railroads, but every other material interest, to astonish the world; not alone with the products of our soil, but with the extent and variety of our mineral resources. These are not confined entirely to the north shore of Lake Superior, as has already been demonstrated, and hence wherever geological indications are sufficiently marked to warrant it, investigations should be put on foot to determine the character and extent of what may prove "sources of wealth" to the State. It might not be amiss to have the State mapped out in districts, and an economical geological survey, authorized by the Legislature, undertaken at no distant period.

That there is an ample field for such investigation to prove both profitable and interesting, there can be no doubt. But I will not digress farther. Fifty-six specimens of copper, similar to those forwarded, have been obtained in the immediate locality referred to, together with a large number rich in iron, and combining iron and copper. Others still, that puzzles the sages of this part of the world, have turned up, whose properties remain to be determined.

Taken in connection with a rich agricultural country, this mineral field offers inducements to actual settlers and capitalists not easily surpassed.

For further information touching this matter I respectfully refer to Hon. Levi W. Wheeler, now in St. Paul, to N. Richardson Esq., Register of Deeds, in Morrison county; or communication may be had with the subscriber by directing to Granite city, Morrison county. T. ELWELL.

mill not behind the best at Rochester, N. Y.—manufactories of woodware—a foundry, and what is of great honor to the State, a paper mill—the products of which meet our wants in our publications daily.

The present cost of Pig Iron at St. Anthony is about $30 per ton, and coal, $15, from Pittsburg, by the cheapest mode of transportation. At Lake Superior Iron is worth from $8 to $12, and Coal from $1,25 to $3, according to quality. With internal improvements to connect, Iron may be deposited at St. Anthony, St. Croix and other water-falls in Central Minnesota for from $12 to $16 per ton, and Coal from $5,25 to $7,00.

The following is the result of experiments upon the tenacity of Iron made by Prof. W. R. Johnson and Major Wade of the U. S. Ordnance Department:

		Strength in lbs. pr. square inch.
Salisbury, Connecicut Iron,		58,009
Sweeds	"	58,184
Centre Co., Pa.	"	58,400
Lancaster, "	"	58,661
Essex Co., N. Y.	"	58,912
English	"	59,105
Russia	"	76,069
Lake Superior	"	89,582

Geographically and physically Minnesota pre-eminently commands a position second to no interior State. Within our borders we have commercial command of outlet to the competing Atlantic markets—an ample surplus of food to sustain a manufacturing population—an abundance of natural power to aid in, and inexhaustible material to convert to useful purposes. Remote from impending strife, our elements and advantages may be made to subserve the arts of *peace* and maintain and foster every industrial pursuit as an independent commonwealth.

Respectfully submitted by your obedient servant,

THOMAS CLARK.

Lake Superior, Minn., January, 1861.