

to examinations for apothecary, on condition that Latin has been an obligatory subject.

VI. That of a *pro-gymnasium*, 1°, to admission to the examination for apothecary; 2°, to admission to industrial technical schools.

VII. That of a *higher-burgher school*, 1°, to attend an industrial or technical school; 2°, to nomination for junior clerkships in the law courts; 3°, to admission to the examinations for art teachers; 4°, to admission to the high school for music in Berlin; 5°, to nomination for junior posts in the post-office.

The high schools are supported by the state, by the commune, or by both. If supported by the state alone, they are known as royal high schools. In the budget for 1885-86 the state subsidy for the high schools amounted to 4,712,118 marks.

### THE SOURCE OF THE MISSISSIPPI.

THE readers of *Science* will recall our announcement a few weeks ago, of the despatch of an exploring party to the head waters of the Mississippi River to examine and locate all the streams and lakes tributary to Lake Itasca. Our explorers have now accomplished their task, and we have received from them a detailed report, and a map of the entire region, which includes the basin of Lake Itasca.

This map, which we have engraved on the scale of about one mile to the inch, divided into sections corresponding with the U. S. land-office surveys, is presented herewith. Other maps are also presented for the fuller explanation of the details of the report.

Preliminary to the report, it is proper that we should make some statement of the considerations which led to the despatch of this party. There have been a number of explorations and excursions to the head waters of the Mississippi during the present century. Of these, we have a more or less accurate record of the trip of Morrison in 1804; of Schoolcraft in 1832; of Nicollet in 1836; of Charles Lanman in 1846; of the Ayers in 1849; of William Bungo in 1865; of Julius Chambers in 1872; of A. H. Siegfried and his party in 1879; of W. E. Neal in 1880 and again in 1881; of Rev. J. B. Gilfillan and Professor Cooke in May, 1881; and of Captain Glazier in July, 1881. We also have the maps of the government surveyors who spent two weeks in this township in September and October, 1875, and the paper of Mr. O. E. Garrison, contributed by him to the tenth annual report of the State geological survey of Minnesota, for the year 1880.

Of these explorers, we know that Nicollet carefully explored all the feeders of Lake Itasca; that

Chambers explored Elk Lake, which he called Lake Dolly Varden; and that Messrs. Gilfillan, Cooke, and Morrison, proceeding from the south, also visited the sources of the lake lying in that direction. Therefore, as to the general facts regarding the size and character of the basin of the lake, we did not hope to add any considerable amount of information to that already possessed. But of all these parties of explorers and surveyors, it is safe to say, that, with the exception of Nicollet and the government land-office surveyors, there has been little attempt at accurate investigation. Only these two have added any thing material to what Schoolcraft told the world in 1832. It is well, therefore, to note the difference in methods, of these two principal explorations of the Itasca basin.

"Nicollet was a trained scientist, but he worked under limitations; and very sensibly, also, with a limited and definite purpose. His work was mainly done alone, and his chief instruments were the thermometer, the barometer, the sextant, and the compass. Hence he gives us details of temperature, elevation, latitude, longitude, and the general direction of the parts he visited. He rarely used the chain — if, indeed, he carried such a piece of property. His details of distance were either estimated — as in the case of a day's tramp or of an object within sight — or figured out by mathematical rules, as when he computed the length of a section of the river from the data of the latitude, longitude, and the direction from each other of a given number of points in its course. Hence his outline of the course of a river or creek, or of the form of a lake or pond, was only as accurate as might be expected from a trained explorer, whose eye was accustomed to take in and measure distance, direction, and form, on a large scale, and under a thousand varying conditions. In the matter of general relief forms, and the general trend and drainage of the country, he was, without doubt, the best equipped and most competent single explorer who has undertaken the study of our country; and his work has been of inestimable value to hundreds of thousands who never heard of his name. So far as relates to the subdivision of areas, and the surveying and platting of the surface of the land, considered as a horizontal plane, his work did not profess to have any accuracy or value whatever.

"On the other hand, this last is the chief, if not the only, object of the government land surveyors. Their instructions are limited and specific. They take no note whatever of relief forms: they follow up and trace only the streams and ponds intercepted by the boundary-lines of sections. In the matter of horizontal area, in the meandering

of lakes and navigable streams, and in the general platting of the land, they are proverbially reliable; but there is absolutely no account taken of elevation, and the drainage or trend of the land can only be inferred from the course and direction of the streams encountered in running the section lines.

"Nicollet's exploration was made in 1836, before a surveyor's stake had been set within the limits of Minnesota. The government surveyors of 1875 perhaps never heard of Nicollet, and certainly had no thought of supplementing or verifying his work."

In addition to the discrepancy noted above, another element of uncertainty has been introduced by the effort to maintain the claims of Captain Glazier as the discoverer of a new lake, unknown before his visit to the Itasca region in 1881. In order to maintain this claim, it is necessary to set aside entirely the map of Nicollet, to discredit the work of the government surveyors, and to ignore Garrison, Siegfried, Gilfillan, and every other explorer who has been to this region during the last half-century. With a dozen trustworthy parties on one side, maintaining the general accuracy of Nicollet and the government land-office map, and with Captain Glazier and his friends alone on the other side, it was not difficult to decide where the truth lay. But as no one had yet attempted to make an accurate survey of the topographical features of this region in the light of a government survey, and as Nicollet's work was simply topographical, without any attempt at accurate platting of areas, there was plenty of room for Captain Glazier, or any one else who chose, to come in and advance all sorts of claims. If, as was claimed by Mr. Pearce Giles on behalf of Captain Glazier, there was found three or four miles south of Lake Itasca another tributary lake, two miles long and a mile and a half wide, this certainly could not be Elk Lake, or any other lake laid down in the government survey. But if, as described by another of his friends, Captain Glazier's lake was less than half a mile south of Lake Itasca, it was undoubtedly Elk Lake,—the same that Nicollet shows, with its three feeders, on his map deposited in the office of engineers at Washington,—the same that Chambers visited and named Dolly Varden in 1872,—the same that the government surveyors accurately outlined and named Elk Lake in 1875,—the same that the Rev. Mr. Gilfillan and Professor Cooke explored and named Lake Breck in May, 1881.

But it was not simply to prove or disprove the truth of Captain Glazier's claim, that we made this effort at an accurate topographical survey of this region. Nicollet has furnished us with a

map and a report of his explorations of the sources of the Mississippi, and these explorations have been a matter of history for fifty years. His maps have been public documents, accessible to everybody; and we believe, that, if his work is to be discredited, it should only be after the most careful and accurate survey. The government surveyors also were charged with having entirely overlooked a lake of more than a square mile in extent, lying several miles south of Lake Itasca. If these government officers are not to be relied upon to give us accurate maps and honest service, it is time that the people should know it; it is time that geographers and map-makers should know it; and we knew of no way so satisfactory as a careful review of the work, both of Nicollet and of the government surveyors. And this review afforded us an opportunity to correct the one by the other, in case they were each reasonably correct in their respective fields of work.

We are glad to be able to report that the most careful running of the lines of the government surveyors have proved the almost absolute accuracy of their work. Our explorers were also able to detect and to account for some interesting minor inaccuracies of the land-office plat of this township; but it was well worth the making of the error to discover the remarkable natural phenomenon whereby this was fully explained. We refer to the underground passage of the stream on the section line between sections 21 and 22, by which the government surveyors were deceived, and led into thinking that the stream did not pass out of section 22 at all, but kept north through the western part of that section.

It is also a cause of satisfaction to find the substantial accuracy of Nicollet's report and map of this region. There are, it is true, manifest discrepancies between his lines and those of the government survey. Lake Itasca is much broader, Elk Lake much smaller, proportionally on his map than on the map of the government survey, and the latter is found to be correct. A large share of this variation is due to the fact that Nicollet made his surveys by the eye entirely, and many of his drawings of the course of the streams and the contour of lakes were made upon birch-bark, and only transferred to paper afterwards. But beside this explanation, our explorers also found reason to believe that Itasca Lake was at one time several inches higher than it is now; and if, on the other hand, Elk Lake was once of a lower level than now, the two coming together would account for the difference in form they exhibited in 1836, as compared with their present outlines.

According to Mr. Gilfillan, the Indians called

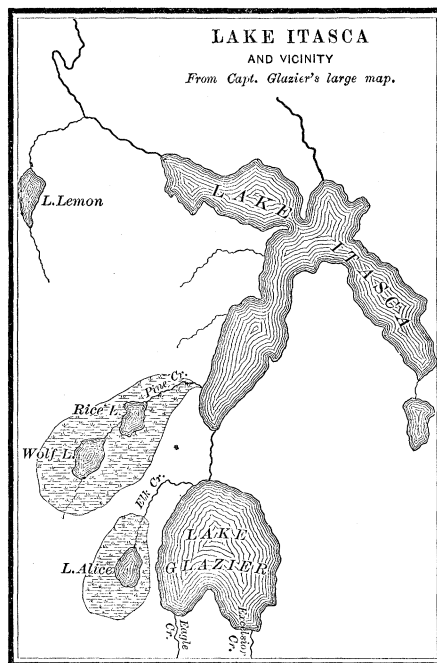
Elk Lake, *Gabukegumag*, which means, 'water which juts off to one side' of another lake; that is, branches or projects out from it like a finger from a hand. This would indicate, that, when this name was given to it, Elk Lake was simply an arm or bay putting out from Lake Itasca, and that with the filling-up of the channel between the two, and the lowering of the level of Itasca, the difference in level, which amounts to only thirteen inches, contributed to make the one lake distinct from the other, and a feeder to it.

We may briefly sum up the results of this exploration to be:—

1. The confirming of the substantial accuracy of the government survey.
2. The proof of the general correctness of Nicollet's report and map.
3. Nicollet's creek is still by far the largest affluent of Itasca, contributing about three-fourths of the regular perennial inflow of water.
4. It can be traced beyond the point to which Nicollet followed it to the lake that heads in section 34, Tp. 143 N., R. 36 W. 5th meridian; and at this point it is 92 feet above the level of Lake Itasca.
5. Following its windings, it is also the longest tributary of Lake Itasca; and therefore,
6. As the largest and longest tributary stream, and the one most elevated in its source, it is entitled to be called the upper course of the Mississippi.
7. Considerable changes have taken place in the nature of the streams in this region since the exploration of Nicollet, but these are all easily accounted for by natural causes.
8. The principal tributaries of Lake Itasca are fed by springs, artesian in their character, which have their reservoirs in the strata of the hills, and in lakes and ponds probably miles to the south and west.
9. There is no large lake directly tributary to Lake Itasca, five, four, three, or two miles, or even one mile south of that lake; and Elk Lake, whose shore is only a stone's throw from Itasca (350 feet), is the only tributary lake within the Itasca basin which has an area of more than 40 acres.
10. Elk Lake, with its feeders, is clearly shown on Nicollet's map of 1836-37. Its position is more accurately given than on Glazier's map; its distance from Itasca is much nearer to truth; and as to its size, Nicollet has drawn it about as much too small as Glazier drew it too large.
11. Captain Glazier has added nothing to what Nicollet's map presents to us. On the other hand,

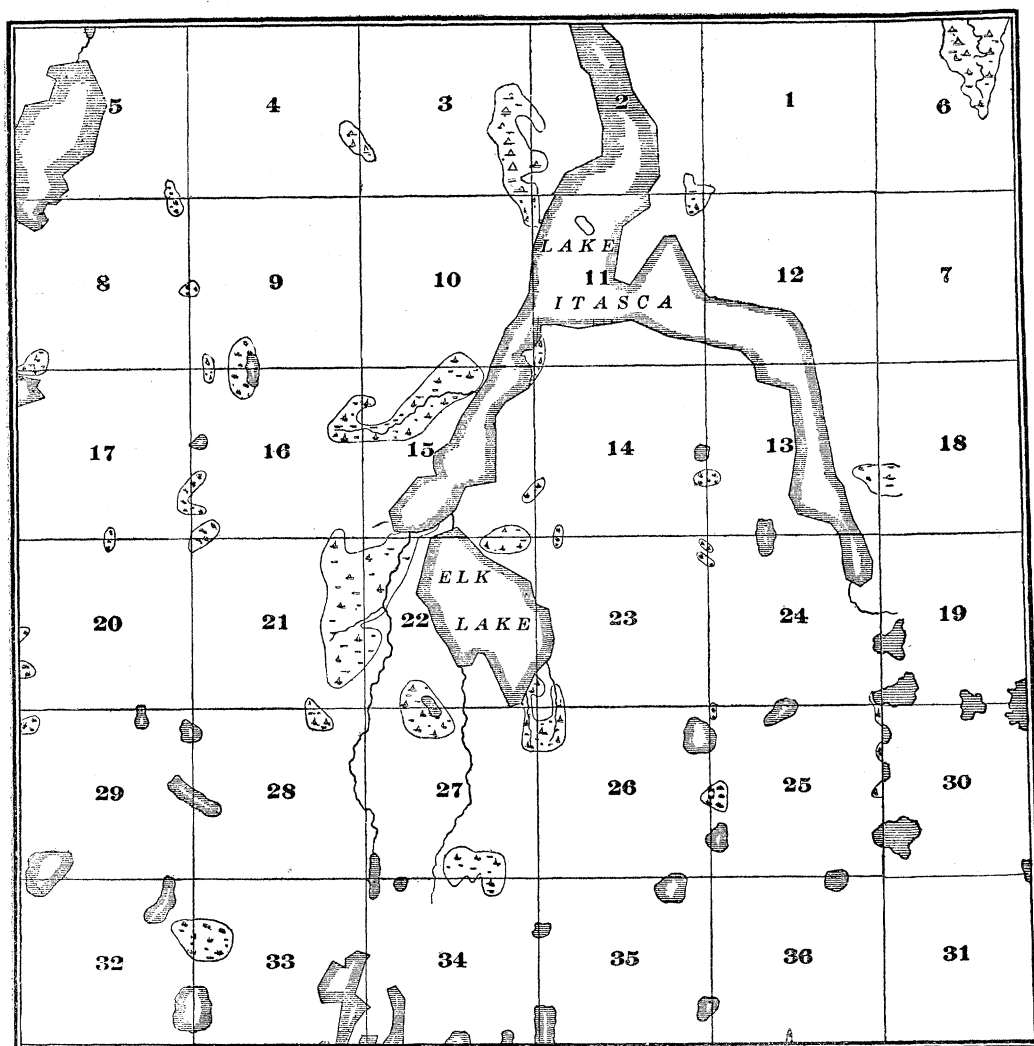
12. Glazier shows us nothing of Nicollet's creek which is the main tributary of Itasca; nothing of the eastern feeder of Elk Lake, which is the main source of its waters; nothing whatever that is not misleading and worse than worthless.

But what is the use of seriously going over this subject? Whatever of merit or accuracy there is in Captain Glazier's map is not in the slightest degree due to any thing done by him, or to any erudition possessed by his guide, Che-no-wa-ge-sic. His map, as he has published it, was drawn and engraved by Mr. G. Woolworth Colton of this city, and was made as near like the government surveys as Captain Glazier would permit.



The public will never be permitted to gaze upon the miserable travesty on geography and map-making which Glazier took to Mr. Colton to be doctored up and put in shape. But it will be interested to read Mr. Colton's account of how he became the innocent accessory of the Glazier fraud. The following is an extract from a published letter of Mr. Colton, to be found in the *American canoeist* for November, 1886:—

"When Glazier came to me in the fall of 1882 with his very rough map, to talk of his claim and to give us the geographical data for adding his streams and lake to our maps, I saw at once that

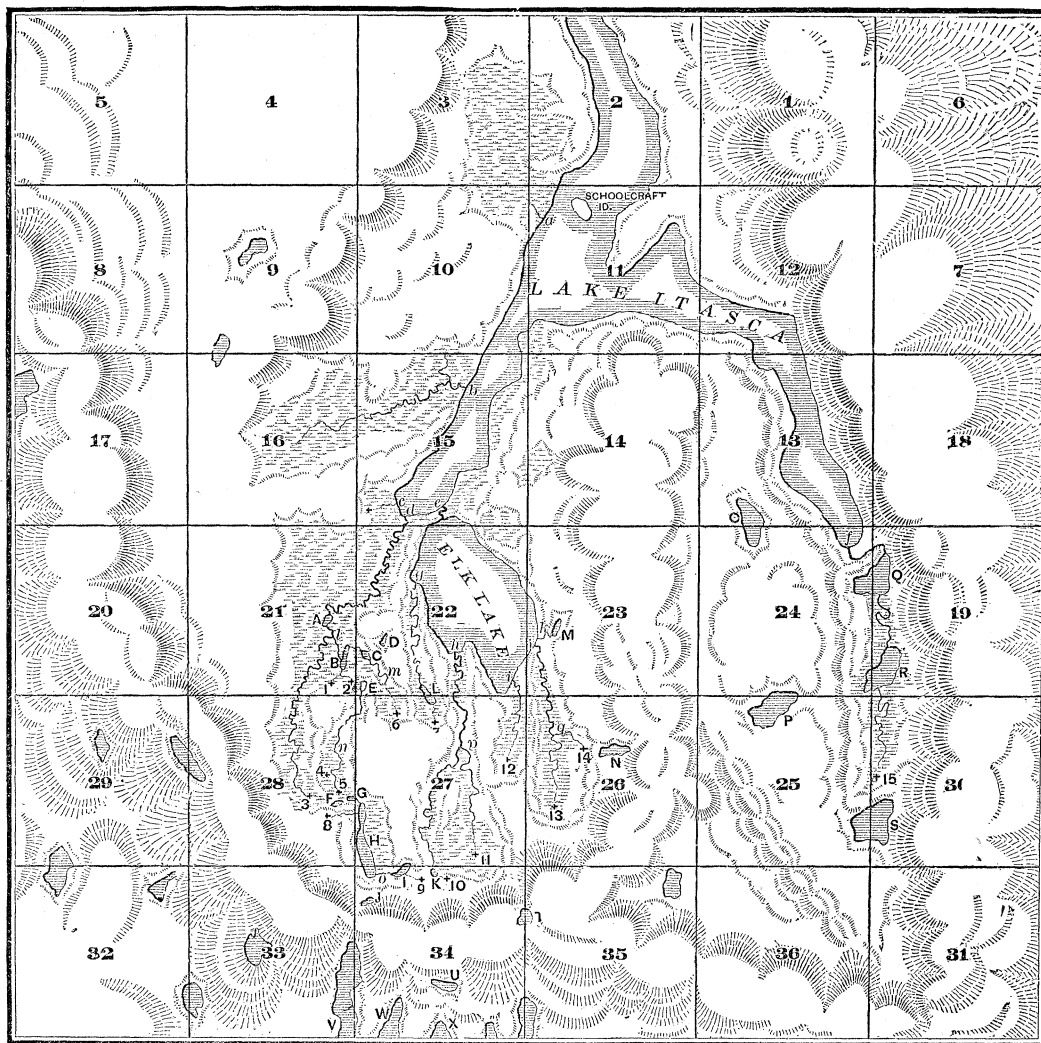


THE ITASCA LAKE REGION, REDUCED FROM THE OFFICIAL PLATS IN THE U. S. GENERAL LAND-OFFICE, WASHINGTON, D. C., AS SURVEYED IN SEPTEMBER-OCTOBER, 1875.

he was claiming what did not belong to him, and so told him. Then I referred to my copy of U. S. land surveys (of which I copy *every one* that enters the general land-office in Washington, on a scale of one mile to one inch, with my own hand), and showed him, under date of March 20, 1876, my copy of sectionized plats, covering not only the region referred to, Nos. 142 and 143, N. R., 36 W., 5th Pm. mer., but all the rest of the area covered by his route to and from the lake. He expressed surprise at the facts shown him, and said he regretted exceedingly that he had not known them before he went, for such maps would have helped him greatly in determining many questions of geography, etc. He concluded to

have his maps engraved, and requested me to add some things and correct others, such as the form and proportion of lakes, etc., and to make more general resemblance to facts, only he insisted on having what he calls Lake Glazier much larger than the *meandered* exhibits on the L. O. plats. The result of my attempts to improve his draught was to make the resemblance to facts greater, and at the same time, as now appears, to give greater strength to his claim of exploration, and to accurate knowledge on the part of his guide."

And now, finally, to settle once for all the worth of Captain Glazier's claim, Mr. Bartlett Channing Paine comes into court, and, *as state's*



THE ITASCA LAKE REGION, AS SURVEYED BY HOPEWELL CLARKE, CHIEF OF THE I. B. T. & CO. EXPEDITION, OCTOBER, 1886.

evidence, gives the following testimony in a recent interview in the *St. Paul Pioneer press*:—

"I wanted to avoid this controversy, but I suppose I might as well tell you whatever I can. Yes, I accompanied Mr. Glazier on his journey at a stipulated salary per week. I went along to write up the incidents of the trip. I suppose Mr. Glazier's object in taking me along was to give a more extended notoriety through what matter I might furnish the press. When we left for the starting-point of our journey, our objective point was Lake Itasca. Glazier had no idea of exploring any lake beyond that point. The idea first entered his head when we were part way between Brainerd and Leech Lake. There

we met an old man who told us that Itasca was not the farthest lake, and that there was another one a little beyond Itasca. Glazier then began inquiring among the Indians, and he finally found one who seemed to know all about this lake. He had, according to his story, grown potatoes on the bank of the lake. That settled it: so Captain Glazier decided to see this lake. We struck Lake Itasca about halfway up the south-east arm, and paddled to Schoolcraft's Island. Next day we made our camp a short distance from the end of the south-west arm to the lake that the Indians had told us about. Glazier was greatly delighted with the lake. We sailed around it till we came to the promontory shown in the map. There the captain made a great speech about the

discovery of the source of the Mississippi. When he finished his speech, I, on a suggestion previously made by him, proposed that the lake be named 'Lake Glazier.' The third member joined in the suggestion, as did the Indians. That night we began our return journey, and when we reached St. Paul I went up and examined the charts in the surveyor-general's office to see if the lake was an actual discovery. I found it was on the government maps, but I did not tell Glazier. Why? Oh, well, I thought I would let him think he had made a discovery. I accompanied him to the Gulf of Mexico. He had no more claim to the discovery than you have. Mr. Glazier recently wrote to me, asking if I had any objections to his using my signature to a few communications to certain newspapers or magazines. I replied that I had. There has since appeared an article in the December number of *Outing* on the subject of this controversy. It had my name attached, but I don't know by whom it was written. I didn't write it. In Mr. Glazier's recent letter I see that he puts forth the statement that the lake was named 'Lake Glazier' contrary to his wishes, and that he desired the Indian name 'Pokegama.' That statement is not true. The captain was not only anxious, but extremely solicitous, that the lake should be named 'Lake Glazier.' Captain Glazier took no observations at Elk Lake. He had no instruments with him."

As to the name of Elk Lake, the former surveyor-general of Minnesota, who had charge of the government land-office at St. Paul, states, that, acting in accordance with his general instructions from the government, he called it Elk Lake, in order to retain the designation originally used by the Indians for the larger lake, which Schoolcraft named Itasca. We certainly think that the official designation should stand.

It will be noted that the map shows parts of two adjoining townships. The six eastern sections (square miles) are in township 143 N., range 35 W., and the other thirty sections are in township 143 N., range 36 W., 5th principal meridian.

It only remains for us to say that we can most thoroughly vouch for the care and accuracy with which this exploration has been made. Mr. Hope-well Clarke, the chief of the party, has long been one of the most experienced and capable land explorers of the N. P. R. R. Co. In this service he has spent years in inspecting the timber, and verifying the work of the government surveyors throughout the immense land-grant of that company. We placed at his disposal every instrument for an accurate determination of elevations, levels, and drainage, which could be desired for the most complete execution of his work. He had in his party two capable assistants; and we place the record of their exploration before the public, satisfied that it is the conscientious work of the very

best men whom we could command for the important task which we undertook to accomplish.

IVISON, BLAKEMAN, TAYLOR, & Co.

#### THE REPORT.

MESSRS. IVISON, BLAKEMAN, TAYLOR, & Co.

753 Broadway, New York.

*Gentlemen*, — I herewith submit my report of the trip to the head waters of the Mississippi, undertaken in your interest in the month of October last. Among the causes of delay in forwarding this paper, were my sickness immediately after my return from Itasca; the great quantity of facts contained in my field notes, which I desired to condense as much as possible; some mishaps which always enter more or less into such undertakings; and a great pressure of regular work in the line of my daily duties consequent upon my absence and illness.

The route which I selected for my trip was by N. P. R. R. to Morley; thence by stage to Park Rapids; and the balance of the way by wagon conveyance to the south-eastern arm of Lake Itasca.

The company consisted of three persons,—one a trained land-explorer, a second to serve as driver and general assistant, and myself as the leader of the party. I had originally planned taking others with me; but I am satisfied, that, with the amount of work we had to do, it would have taken twice as long with help not accustomed to the woods, and I am afraid we would have killed a green man, travelling and working as we did. So, though at first I was disappointed at the loss of one or two whom I had expected to have with me, I am satisfied that the party would not have been better made up than as it was.

In the matter of equipment for measurements and for observations, we had the following: pocket-sextant, aneroid barometer, drainage-level, Locke's hand-level, thermometers, surveyor's compass and chain, levelling-rod, pocket-compasses.

We arrived at the south-eastern arm of Lake Itasca at noon on the 13th of October, and after taking dinner embarked at once for the south-western arm, which we proposed to make the centre of our operations. We approached this portion of the lake with considerable curiosity, and as we drew near our journey's end we stopped a few moments to admire the scene before us.

Directly in front, a small, bare, mound-like elevation or knoll rises from the edge of Lake Itasca near the centre of an open space of about ten acres between it and Elk Lake. The inlet of the principal stream flowing into Lake Itasca is seen on the right, and the outlet of Elk Lake comes in at the left, of the knoll. We are looking south-

ward; and to the right the shore of the lake is lined with pine, while the left shore and all the upper (southern) end is bordered with tamarack, except the open space in front, which is bare except for a few bushes and some rice-grass. The Height of Land is in plain view two miles and a half to the south; and between these hills and the knoll there is a peculiar light familiar to woodsmen, which indicates an opening or water beyond. It is a striking scene. There is nothing like it anywhere else on the shores of Itasca. And while looking at it, our thoughts went back to the time Nicollet was there; and we could not but reflect that Francis Brunet, or Kegwedzissag, his Indian guide, would call his attention to it, and no doubt they landed and explored Elk Lake before they went in any other direction. The moment we saw this open country between the lakes, we were satisfied that no man accustomed to the wilderness, certainly no explorer of Nicollet's experience, no guide as trained as his Indian was, could go there on the business on which they were engaged, and miss seeing Elk Lake, unless he were blind.

As night was rapidly approaching, we landed, and selected a place for camp in the open space between the two lakes; and while one of my assistants was busy pitching camp, and the other prepared supper, I employed the time till dark unpacking and adjusting my instruments, and planning the work for the following days. In all, we spent five days exploring and surveying the basin of Itasca. Wherever there was especial care and detail required, we gave our best and most diligent efforts to the work, and I believe there is no material point regarding the sources of the feeders of Lake Itasca which is not covered by this report.

In presenting the results of our work during our stay at Lake Itasca, I shall not attempt to report the operations of each day, but rather state the general conclusions and facts obtained from the thorough exploration of every part of the basin of the lake.

In following the heights of land which form the southern boundary of the basin of Lake Itasca, the general trend of the crest is from north-west to south-east; but it takes a course almost directly east after striking the north-east quarter of section 33, as shown on the map. It also sends out spurs, one striking northward from section 35, and another, also northward, from section 31 in the eastern of the two townships shown. The spur striking north from section 35 divides the Itasca basin into two parts, the western furnishing the feeders of the south-western arm of the lake, and the eastern furnishing the

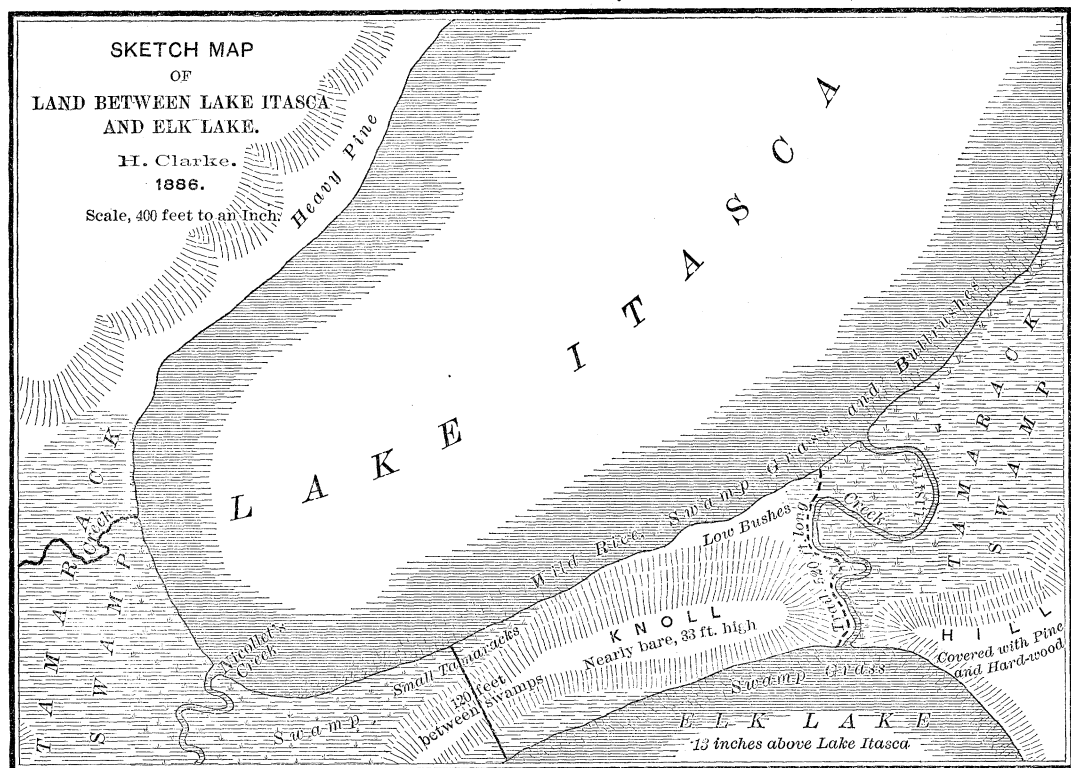
single feeder of the south-eastern arm. It is not an unbroken ridge of hills, nor are these spurs perfectly defined; but they are, rather, groups and successions of hills, with the general direction given above. There is also a marked difference in the character of the springs of these two parts of the Itasca basin. The western bowl furnishes the feeders that are steady and constant during the year, and the largest feeder lies at the extreme western edge of this bowl. The eastern bowl furnishes a single feeder, which is probably nearly dry parts of the year. It is thus evident that the western streams are fed mainly by living springs, artesian in their character, being supplied by water which comes through the strata of the earth from ponds to the west and south, some of them, perhaps, miles away. The single stream of the south-eastern arm simply drains the bowl in which it flows, and while in the rainy season it may be quite a torrent, part of the year it is comparatively dry. I regard this as important in determining the ultimate sources of the waters of the upper Mississippi, it being evident that all the water which flows into the river from Lake Itasca is either surface drainage or comes from reservoirs and ponds which lie between the head waters of the Mississippi and the head waters of the Red River. To the north the elevation of the crest of the Height of Land varies from 150 to 250 feet above the level of Lake Itasca. In the western half of section 21 the height is about 200 feet; in sections 28 and 33 it rises to 225 and 250 feet; in section 34 it is 250 feet in the west part of the section, and 200 feet in the eastern; 175 feet in section 26. In section 23 the height is 100 feet, sloping gradually to 75 feet in section 14. The knoll in the western part of section 22 is 150 feet above the level of the lake. To the north, along the border of Elk Lake, the ridge is 90 feet high. Just south of the lake marked *D* the elevation is 120 feet, and just north of the lake marked *E* it is 100 feet. These data are sufficient to show the irregular and broken character of the land in this region.

One of the most interesting parts of our work was the survey and examination of the narrow strip of land between Lake Itasca and Elk Lake. We found it to be 350 feet wide at the narrowest point between the lakes, and 520 feet measuring along the crooked trail at the base of the knoll. The lakes run nearly parallel for 1,020 feet, and the strip of land contains in all about 10 acres.

The portion shown as hilly on the plat is a small mound-like elevation, nearly devoid of all timber, which rises with a gradual slope south from Lake Itasca to a height of 33 feet, and descends abruptly to the shore of Elk Lake. Its direction between

the lakes is nearly east and west. Its height above Lake Itasca at its western base is 10 feet, where it is less than 100 feet wide; and thus, if each lake were a little higher in elevation, they would at this point be within 100 feet of each other. The highest point on the trail between the two lakes is 12 feet. The ridge extends to the outlet of Elk Lake, from which point Lake Itasca is in full view. Another hill rises to the east of the outlet, leaving an opening 12 feet wide, through which the stream flows with a rapid cur-

nothing from springs along its route, and its increased width and depth are caused by back water from Lake Itasca. It is a very pretty little stream, and has been cleared out by the Indians, who go there annually and place fish-traps to catch the fish that run between the two lakes. The difference in elevation between the two lakes is 1 foot and 1 inch. The stream between the two lakes falls 6 inches between Elk Lake and a point where it enters the tamarack swamp, in the first hundred feet of its course; the balance, 7



rent, in a channel 6 feet wide and 6 inches deep. The balance of the land between the two lakes on either side of the creek, is a tamarack swamp. The outlet of Elk Lake flows nearly north-east 80 feet, and enters the tamarack swamp, where its general direction is north for 600 feet, until it reaches a point within 110 feet of Lake Itasca. It then curves back toward Elk Lake, and finally enters Lake Itasca, its whole course from Elk Lake measuring 1,084 feet. Where it debouches into Lake Itasca, it is 7 feet wide and 8 inches deep. We noted its width at numerous places in its course, and found it to vary from 6 to 12 feet, and its depth from 2 to 8 inches. It gains

inches, measures the fall in its course through the tamarack swamp of nearly 1,000 feet.

Leaving this interesting part of the lake for a time, I will give some details in regard to the other feeders of the lake. The stream entering the south-east arm, as above remarked, is evidently quite variable in its character. At times, apparently, it is very shallow; but after heavy rains it is quite a torrent, and drains the lakes which form during the wet season, marked Q, R, and S. When the stream is at its best, it is fully 6 feet wide and a foot deep. The stream entering Lake Itasca at *a* is merely a sluggish creek, draining the marsh to the northward in sections 23 and



10. The stream entering at *b* rises in a swamp on section 16, and is joined by a branch in section 15, which rises in section 10. There are numerous springs along its course, and it is 8 feet wide and a foot deep, at its mouth discharging as much water into Lake Itasca as the outlet of Elk Lake does. The inlet at *c* is a small brook, 2 feet wide and a foot deep, that rises in a swamp less than a quarter of a mile from the lake.

This brings me to the largest feeder of the lake, the one entering at *d*. It is 16 feet wide and  $2\frac{1}{2}$  feet deep at the place where it enters into Itasca, and is the stream mentioned by Nicollet, in his report of his explorations in 1836, as "the one remarkable above the others, inasmuch as its course is longer and its waters more abundant; so that, in obedience to the geographical rule that the sources of a river are those that are most distant from its mouth, this creek is truly the infant Mississippi; the others below, its feeders and tributaries." The exploration of this stream was the most complicated and difficult of our undertakings, and it was with considerable difficulty that we were able to identify the three lakes which Nicollet describes; but while on the ground, and after the most careful study of the problem, we came to the conclusion that Nicollet's three lakes were those marked on the map as *A*, *B*, and *C*. At first sight, it would seem, from Nicollet's description, that these could not be the ones he referred to; and I have given much study to the points involved, endeavoring to reconcile his descriptions with some other theory. We followed the stream to the first lake at the edge of the hills and through the swamps; and the course of the brook is two miles in length, and seemed like four. Distances on the ground double up very fast when one follows crooked streams, as you will remember when you compare the length of the stream between Elk Lake and Lake Itasca (1,040 feet) with the actual distance between the two lakes (350 feet). If we add to the actual length of the course of the stream from the lake *A* to its outlet at *d*, which is in reality 2 miles, the difficulties that Nicollet encountered in wading through the tamarack marsh, we can easily believe that this is the course which he describes as 'two or three miles' in length. His report makes the distance between the first and second lakes comparatively short, and that between the second and third lakes still shorter, so that there is no other lake which answers the description for the third or higher lake but the one marked *C*. This, however, is not the source, at the present time at least, from which Nicollet's stream draws its principal supply of water; and to find that source, after considerable exploration, we were obliged to

go to a lake which has its head in the north-western quarter of section 34. This is the utmost source and fountain head of the water flowing north into Lake Itasca. The lake itself is fed by numerous springs along its borders, and its surface is 92 feet above the level of Lake Itasca. The small inlet from the lake marked *I* was dry when we visited it, but water runs through it in the wet season. The hills south rise from 20 to 160 feet high, and water has never flowed over them northward. It might be interesting to know how far it flows under them. It is certain that it does, but there is no way to trace its course or distance. All the streams in this part of the basin rise in springs in tamarack swamps, which undoubtedly are fed by water percolating under the hills from lakes and swamps beyond; and no doubt the group of lakes, *U*, *V*, *W*, and *X*, in the southern part of sections 33, 34, and 35, which spread out to a considerable extent in sections 3, 4, and 5 of the townships next south, are the reservoirs which feed a number of these springs. Beginning with the lake marked *H*, it spreads northward nearly half a mile. At its northern end the water flows out of this lake in a stream  $1\frac{1}{2}$  feet wide and 1 foot deep, and, running west about 200 feet, empties into a small lake about 2 acres in extent, marked *G*. This lake connects with another of the same size about 20 feet to the west of it.

At the time we were there, both ponds were full of moss and bogs, and apparently almost dried up, the abundant inflow of water running out by underground passages as fast as it came in; but both lakes show that at some seasons of the year they contain 4 feet more of water, caused by the increased flow in the springtime and in the rainy season. At this time the underground passages are not large enough to carry the water off, and so it accumulates and the ponds fill up. Apparently they once had a surface outlet which is now closed by a beaver dam. The water flowing from the two lakes feeds the two springs numbered 3 and 5. Proceeding to the spring marked 5, we find the water bubbling up and flowing away in a rapid, lively stream, in a direction generally northward. It is fed by springs along its course until it reaches the extreme south-western corner of section 22, where it is  $2\frac{1}{2}$  feet wide and 8 inches deep, and discharges into a small pond of about 5 acres in extent. This pond is the most remarkable one in the course of the stream; it has no surface outlet, and, from the formation of the land about it, apparently has never been any larger than it now is; but, with the large volume of water flowing into it, we perceive that it must, of course, have a steady

and sufficient outlet underground. This we found to be toward the west, where it bursts forth in an immense spring or pool, marked 2, in the extreme south-eastern quarter of section 21. The lowest point on the hill between the pond and the spring is 12 feet above the level of the pond; and the water, dropping underground, bubbles up in the swamp 200 feet away and 33 feet below that level. You will notice that the stream thus passes underground from section 22 into section 21, and is therefore invisible to one following up the course of the section line, — a fact which will be referred to again in a latter portion of this report. Proceeding from the spring marked 2, the water flows in a north-westerly direction, and empties into the lake marked *B*, — the second one of Nicollet's chain of lakes. The outlet of this lake is on the west side, a stream 3 feet wide and a foot deep, which is joined at a short distance by another from the south. Following up the stream, which joins the main one on section 21, we find it rises on section 28 at a spring marked 3, evidently fed by an underground passage from the pond *F*. These streams are re-enforced throughout their course by springs which ooze from the bases of the hills that line the tamarack swamps; so that, when the creek leaves lake *A*, it flows with a brisk current 12 feet wide and 1 foot deep, which is further re-enforced by numerous springs all the way to Lake Itasca. At the point of its discharge into the lake, it is a broad, well-defined stream, 16 feet wide, and  $2\frac{1}{2}$  feet deep at its deepest point. Lake *A* is ten feet above the level of Lake Itasca.

Recurring to the subject of Nicollet's three lakes, I recall the fact that Nicollet states, that, at a small distance from the heights where the head waters originate, they unite to form a small lake, from which the Mississippi issues with a breadth of  $1\frac{1}{2}$  feet and a depth of 1 foot. "*At no great distance, however,*" so Nicollet says, "*this rivulet uniting with other streamlets, supplies a second minor lake,*" so we were obliged to look for the upper of the three lakes at a reasonably short distance from the lake *B*. If the spring, numbered 2, would fill the bill as a lakelet, it would meet all the other requirements of the case perfectly. The only alternative seemed to me to be the lake marked *C*. At present the outlet of this lake is obstructed by two beaver dams, and no water flows from it except what little may percolate under these obstructions. Its principal feeder, marked *m*, rises in a spring in section 27, and is also nearly dry, but there is a small amount of water flowing through its channel. I leave it to you, or to future explorers, to settle the question as between the spring 2 and the pond *C*.

There are four small streams flowing into Elk

Lake. The first one rises in a spring, the outlet of which flows into a small pond 50 feet in diameter in the north-western quarter of section 34. It leaves this pond a brooklet 6 inches wide and 2 inches deep, and flows with a rapid current to the centre of section 37, where it is joined by another and larger branch coming from a tamarack swamp in the south-eastern quarter of section 27. At the point where it flows into Elk Lake it is 2 feet wide and 6 inches deep. The elevation of the source of this stream at the spring marked 10 is 88 feet above Elk Lake and 89 above Lake Itasca. The *largest* stream flowing into Elk Lake rises in the north-western quarter of section 26 in a spring marked 13. This is joined, at a short distance from its source, by another branch, which is supplied by a small lake in section 26, marked *N*. The outlet of this lake is by an underground current, it being closed by a beaver dam; but water has flowed out by a surface outlet at some period, perhaps at the time of Nicollet's visit. Where the main stream enters Elk Lake it is 3 feet wide and a foot deep. This lakelet *N* in section 26, and its outlet, were to me among the most interesting things found in this region. To my mind they prove conclusively that Nicollet not only explored Elk Lake, but also its feeders. Referring to the copy of his larger map, which you sent me, I find just such a lake laid down at the head of a small stream flowing into Elk Lake from the south-east. This is the most important feeder of Elk Lake, just as Nicollet indicates it to be. The other two streams flowing into Elk Lake are quite small, and originate as shown on the map. We found a dry channel between the lake *M* and Elk Lake. No water was flowing from this lake, although it probably does discharge some water in the spring and when the water is high. In measuring the amount of water supplied by the various tributaries of Lake Itasca, we found the three streams discharging at *b*, *d*, and *e*, furnishing practically all the perennial water-supply of the south-western arm of the lake; and of this I would estimate that Nicollet's creek furnishes  $\frac{3}{4}$ , and the other two, each about  $\frac{1}{4}$ .

#### THE WORK OF THE GOVERNMENT SURVEY.

It was an important part of our task to observe the posts and blazings left by the government surveyors, and we carefully ran the main lines with the view of detecting any errors that they might have made. In this part of their work, and also in meandering of the two lakes, our examination proved their work to be correct in every material point. A singular mistake, however, on the government plat, is easily accounted for. The course of the stream from lake *H* until it crosses the south

line of section 22 is substantially correct as laid down on the government map: but, when they ran the line between sections 21 and 22, this stream was not crossed again, and they naturally supposed it ran due north through the western edge of section 22, and that the stream flowing out of section 21 into 22 was a branch running into the main stream; whereas this is the main stream, which, passing westward under their feet into section 21 by an outlet which they did not see because it was underground, takes its course through the eastern part of section 21, and crosses into section 22 again at the point where the government surveyors had indicated a feeder to the main stream. The two small lakes *C* and *D* on section 22, and the two *A* and *B* on section 21, would not be crossed by a section line: hence they were not indicated by the surveyors. At a point where the section line between sections 21 and 28 crosses the branch of the spring flowing out of section 28, the course of the stream is through a boggy swamp, and it would hardly be noticed as the stream without going a considerable distance north or south of the section line: hence it is not shown on the government maps, but in place of it is shown a marsh. In all other respects the work of the government surveyors is well done. Their business was to establish section corners, blaze lines between the sections, note all lakes intercepted by the section lines, meander lakes of more than 40 acres in extent, note streams crossed and indicate their apparent direction, etc. Trifling errors will creep into their work; but, when we take into consideration the difficulties they have to contend with, it is not to be wondered at.

Another part of the duty of the government surveyors is to indicate the names of streams and bodies of water, and, in case no modern name has been given to them, to retain the Indian name or its English translation. Following this rule, the name of Lake Itasca, being generally accepted, was retained.

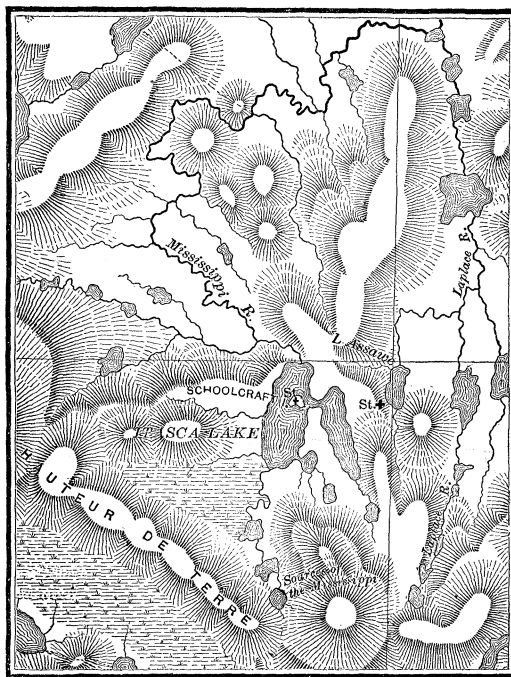
With regard to the name of Elk Lake, Mr. Hall, who was the chief of the surveying party of 1875, recently told me that when he was surveying township 143 N., range 36, he met an Indian trapper at Lake Itasca, who had made this region his trapping-ground for years. He asked him the Indian name of Lake Itasca and Elk Lake, and the Indian gave him the name of 'Omushkos,' or 'Elk,' for the lake in section 22, and another name, which Mr. Hall has forgotten, for Itasca. As Lake Itasca had a name already, he simply recommended to the surveyor-general the name 'Elk Lake' for the other body. But the Indians are by no means agreed upon the designa-

tion for these lakes. They certainly gave Mr. Schoolcraft the name 'Omushkos' for Lake Itasca, and to Mr. Gilfillan, 'Gabuwegumag' for Elk Lake. The latter term signifies 'water that juts off to one side' of another lake; that is, branches or projects out from it like the fingers from the hand.

Other travellers have found still other designations applied by the Indians to these lakes. Surveyor-general Baker, in fixing the name finally to be applied to the lake, considered, that, whether 'Omushkos' was the original designation of Elk Lake or of Lake Itasca, it was worth while, in the absence of any other fitting name, to retain that designation for the lake which was not yet named. I am certainly of the opinion that the name should stand.

#### NICOLLET'S MAP, ETC.

It is fitting to say a few words in regard to Nicollet's map and possible changes, past and



ITASCA LAKE AND VICINITY. FACSIMILE COPY OF NICOLLET'S MAP DEPOSITED IN THE OFFICE OF ENGINEERS, U.S.A., 1836-37.

future, in the Itasca region. Careful investigation along the shores of Lake Itasca shows plainly that some time in the past it has been 9 inches higher than it is at the present. This rise would be sufficient to overflow all that portion of the

land shown as tamarack on the plat of land between Elk Lake and Lake Itasca, and back the water up to the narrow strip of high land on the outskirts of Elk Lake, thus bringing the lakes within 80 feet of each other. Whether this was the case when Nicollet was there, I will not attempt to answer. His map would seem to indicate that it was, by the fact that he shows the two lakes so closely connected, Elk Lake so much larger than it is, and the two arms of Lake Itasca so much out of proportion with their present outline. But this can readily be accounted for on other grounds. The shores of the south-eastern arm are abrupt and bluff, while the shores of the south-western arm are low and swampy. This makes the south-western arm look wider than it is, and the south-eastern arm narrower than it is. The shores of Elk Lake are also abrupt and lined with bluffs, and to one looking south across it, it does not look half as large as it does to one standing on the hills south of it and looking north. Distances across water are always deceiving. The view from different points of Lake Itasca might be sketched by a dozen different parties, and no two sketches would look alike. My impression is, that Nicollet sketched the south-eastern arm of Lake Itasca from some point on its western shore and Elk Lake, and the south-western arm of Itasca from the knoll between the lakes; and when we take into consideration how insignificant is the distance between the two lakes, compared to the total length of both, it can readily be understood why he has shown them as though Elk Lake were a bay instead of a separate body of water. From the nature of the springs which feed the principal stream emptying into Lake Itasca, it is evident that very few changes have taken place in that part of the basin since Nicollet was there, and very few will take place in the next fifty years. The springs that feed it are supplied by underground currents and reservoirs from the lakes and the Height of Land, and, as they cannot be drained, no amount of settlement or clearing will change them. They are among the permanent features of the country. Lake Itasca of to-day is the same in its main features that it was when Nicollet was there, and for a hundred years before. Its level may have been a little higher, the surface of Elk Lake may have been a little lower, Itasca may have spread out over some acres more of marsh, Elk Lake may have been somewhat smaller in its surface extent; thus they may have come more nearly together, and nearer to being one continuous body of water. But the main features of this remarkable basin will remain the same for generations to come, and Lake Itasca will be then, as it is now, the first important reservoir of all the

springs that feed the head waters of the Mississippi River.

Our meteorological observations were taken with an effort at system; but it is sufficient, perhaps, to say that the atmospheric temperature varied from 20 to 70 degrees during the five days that we were at Lake Itasca, and that we had the extremes of clear weather and invigorating atmosphere, and of desolate, soaking rain. The severest storm overtook us when we were within 5 miles of Lake Itasca, and we passed a most unenviable night in an improvised camp. We took the temperature of the water in Elk Lake and Lake Itasca when the temperature of the atmosphere was 51° F., the temperature of the water being 46°. The temperature of the water in the second lake on Nicollet's creek was 42°.

Among the mishaps which invariably attend such explorations, were two that are worthy of note, — the loss of my revolver, and the leaving behind, unaccountably, of my copy of the Nautical almanac. I had intended taking the latitude of the northern end of Elk Lake, and also establishing a meridian and noting the exact variation between the true and magnetic meridian; but when I got on the ground, of course this was impossible without my tables. Still worse luck followed the observations with the barometer. I had arranged with Sergeant Lyon, of the U.S. signal service at St. Paul, to take simultaneous readings of the barometer. The instruments were adjusted together when we set out for Itasca, but, when we got back to St. Paul, mine read 200 feet higher than his. As there was no way of determining when this change occurred, all that work was of no account. As our first observations were taken at 6 A.M., and the last at 10 P.M., they involved considerable sacrifice of rest, which I am sorry yielded so little result.

The figures given in the first part of this report for the elevation of the crest of the Height of Land are therefore necessarily only approximate, as the variation in my aneroid barometer destroyed the value of my observations, on which I largely depended for this part of my work. The heights noted for elevations between the lakes and for the springs and streams were obtained by the drainage-level, and these may be relied upon as practically correct.

I considered it very fortunate that our trip was made just at the end of a long spell of dry weather such as has hardly been known in Minnesota for years. This enabled us to judge of the sources of water-supply that are perennial in their flow, as distinguished from the surface drainage in the spring and in the rainy seasons. The rain of the night before we reached the lake was

not enough materially to disturb these conditions.

The last thing we did before leaving our camp between the lakes was to erect on the top of the little knoll, in plain view from both lakes and from Schoolcraft Island on the north, a monument to the memory of Nicollet, on which was inscribed the following: "To the memory of J. N. Nicollet, who discovered the source of the Mississippi River, August 29, 1836." This was done after fully exploring the country for miles around; and our little party of three was fully satisfied that fifty years ago Nicollet had discovered all there was to discover of the sources of the Mississippi; and that if he had lived to complete his report on 'The sources of the Mississippi and the North Red rivers,' and to give to the world his unpublished map, there would have been no chance for any Glazier to confuse the geographical world, or to play tricks upon the learned societies of two continents. We found our work difficult enough, though we were only a day's ride from civilization and the railroad, and though the whole township had been marked off and blazed at every turn by the government surveyors. What, then, must have been the heroism of the invalid devotee of science, who buried himself for months in the unbroken wilderness, and gave his life to the exploration of the frontiers of his adopted country!

I have done my work without any prejudice or bias, and determined only upon finding out and stating the truth in regard to the sources of the great river of our continent whose exploration has commanded the service of so many worthy men in every period of our history.

As a preparation for the survey, I had read every thing I was able to gather on the subject, and I took with me tracings of all the maps of the region, either published or to be found in the government departments. The work has been done by actual survey, and in such a way that I believe it will bear investigation by any surveyor who wishes to check it.

HOPEWELL CLARKE.

Minneapolis, Minn., Dec. 7, 1886.

#### THE BRITISH SCHOOL AT ATHENS.

A WRITER in the *Athenaeum* states that the managing committee have now drawn up and will immediately issue a series of rules and regulations for this school. Its objects are declared to include, 1°, the study of Greek art and architecture in their remains of every period; 2°, the study of inscriptions; 3°, the exploration of ancient sites; 4°, the tracing of ancient roads and

routes of traffic; and, further, the study of every period of Greek language and literature from the earliest age to the present day. The students of the school will fall under the following heads: 1°. Holders of travelling fellowships, studentships, or scholarships at any university of the United Kingdom or of the British colonies; 2°. Travelling students sent out by the Royal academy, the Royal institute of British architects, or other similar bodies; 3°. Other persons who shall satisfy the managing committee that they are duly qualified to be admitted to the privileges of the school. Students attached to the school will be expected to pursue some definite course of study or research in a department of Hellenic studies, and to write in each season a report upon their work. Such reports are to be submitted to the director, and may be published by the managing committee if and as they think proper. Intending students are required to apply to the secretary, Mr. George Macmillan, 29 Bedford Street, Covent Garden, London. No person will be enrolled as a student who does not intend to reside at least three months in Greek lands. Students will have a right to use the library of the school free of charge. So far as the accommodation of the house permits, they will (after the first year) be admitted to reside at the school building, paying at a fixed rate for board and lodging. The managing committee may from time to time elect as honorary members of the school any persons actively engaged in study or exploration in Greek lands.

The director is to deliver at least six free public lectures at Athens during the season, and at the end of each season he is to report to the managing committee upon the studies pursued during the season by himself and each student. A sub-committee has been appointed to purchase books for the library so far as funds will allow. Presents of books or pamphlets will be gratefully received and acknowledged by the honorable secretary.

#### THE 'NATURAL METHOD' OF LANGUAGE-TEACHING.

No single word has created so great a confusion of thought as the word 'natural.' Its bare etymological meaning is plain enough; but its application is confined by the bounds of no dictionary, and its sense is as mutable as the shifting sands of the seashore. No other word has so often been used by writers as the convenient vehicle of their own individuality. 'Natural' is often simply what one desires from his own particular view to be natural. It is necessary, accordingly, always carefully to scrutinize its use, and thus to discover