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34TH CONGRESS, 1st Session. } SENATE. { Ex. Doc. No. 76.

BOTANICAL GARDEN.

EXPLORATIONS

IN THE

DACOTA COUNTRY,

IN THE YEAR 1855.

BY

LIEUT. G. K. WARREN,

TOPOGRAPHICAL ENGINEER OF THE "SIOUX EXPEDITION."

WASHINGTON:
A. O. P. NICHOLSON, SENATE PRINTER.
1856.

REPORT

OF

THE SECRETARY OF WAR,

IN COMPLIANCE

With a resolution of the Senate of the 9th ultimo, calling for a copy of the report of Lieutenant G. K. Warren of his exploration of the country between the Missouri and Platte rivers and the Rocky Mountains, together with the maps accompanying the same.

MAY 7, 1856.—Read ; motion to print referred to the Committee on Printing.

MAY 14, 1856.—Report : "resolved that it be not printed." Mr. WELLER, to amend by striking out the word "not." Postponed until to morrow.

MAY 22, 1856.—Amended, considered and agreed to. Resolution agreed to as amended.

WAR DEPARTMENT,
Washington, May 5, 1856.

SIR: In compliance with the resolution of the Senate of the 9th ultimo, I have the honor to transmit, herewith, a copy of the "report of Lieutenant G. K. Warren, of the United States Topographical Engineer Corps, of his recent exploration of the region of country between the Missouri and Platte rivers and the Rocky Mountains, with the maps accompanying the same."

Very respectfully, your obedient servant,

JEFF'N DAVIS,
Secretary of War.

Hon. J. D. BRIGHT,
President pro tem of the Senate.

WAR DEPARTMENT,
Washington, March 26, 1856.

DEAR SIR: The Topographical Engineer, Lieutenant G. K. Warren, on General Harney's staff, during the past year's campaign in the region between the Missouri and Platte rivers and Rocky Mountains, has addressed a brief and interesting report (accompanied by a map)

to that officer, which contains much useful and newly acquired information respecting the country and routes, rivers and streams traversing it, &c. The report and maps should be printed, as they will be very useful to the troops on that frontier and to travellers and emigrants.

Very respectfully and truly yours,

JEFF'N DAVIS.

Hon. JOHN B. WELLER,
Chairman Committee on Military Affairs, Senate.

BUREAU OF TOPOGRAPHICAL ENGINEERS,
Washington, April 10, 1856.

SIR: In compliance with a resolution of the Senate of the 9th instant, I have the honor to submit the report and map of Lieutenant Warren, called for by that resolution.

Respectfully, sir, your obedient servant,

J. J. ABERT,
Colonel Corps Topographical Engineers.

Hon. JEFFERSON DAVIS, *Secretary of War.*

WASHINGTON D. C., *April* 9, 1856.

SIR: I have the honor to transmit herewith a copy of a report, made by order of Brevet Brigadier General W. S. Harney, commanding "Sioux Expedition," of my explorations in the Dacota country during 1855, as topographical engineer to the expedition.

It is accompanied by one map on a scale of 1: 600,000, and another on a scale of 1: 300,000, giving the localities of the Indians, and certain vague information obtained from hunters of country not yet explored instrumentally. These maps contain nearly all the reliable map information concerning Nebraska.

There is also a barometric section of the country between Fort Pierre and Fort Kearny.

In the Appendix to my report will be found an interesting memoir, from Dr. F. V. Hayden, of examinations lately made by him in Nebraska.

I am sir, very respectfully, your obedient servant,

G. K. WARREN,
Lieutenant Topographical Engineers.

Colonel J. J. ABERT,
Chief Topographical Engineer, Washington City.

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2. Map, on a scale of 1 to 300,000, giving location of the different bands of Indians, and such other information as could be obtained from the trappers and hunters.
3. Barometric profile of route from Fort Pierre to Fort Kearny

REPORT

OF

LIEUTENANT G. K. WARREN, TOPOGRAPHICAL ENGINEER

OF THE

"SIOUX EXPEDITION,"

OF EXPLORATIONS IN THE DACOTA COUNTRY, 1855.

WASHINGTON, D. C., *March* 15, 1856.

SIR: In obedience to the orders of Brevet Brigadier General Harney, which required me to present a memoir and sketch of the routes passed over during the past season, I have the honor to present this report and the accompanying maps. My duties in connexion with the "Sioux Expedition" required me to go up the Missouri river to Fort Pierre, lay out a military reserve for that post, and examine the river as high up as the mouth of the Shyenne.

Having accomplished this, and rendered a report thereon, I proceeded across the country direct from Fort Pierre to Fort Kearny. From this point I accompanied the army to Fort Laramie, and thence to Fort Pierre. From Fort Pierre I returned to the settlements at the mouth of the Big Sioux, by the direct route through Minnesota.

Over the routes thus traversed, sketches and notes were taken, and collateral information was sought from every available source. I have given the Indian names, as well as the French and English, to objects and localities, and in writing the Dacota words have adopted, as far as possible, the spelling used in the Dacota Grammar and Dictionary, published by the Smithsonian Institution. Dacota being the proper name for the so called Sioux.*

The routes traversed lead over the great plains between the Missouri, the Platte and the Shyenne, and nowhere entered the mountains. Of the geology of this interesting section, which is believed to be mainly of the tertiary and cretaceous formations, much new information has been gained by Dr. F. V. Hayden, who is at present preparing his results. To his preliminary report [in Appendix E] I would call especial attention on account of its general interest.

A note concerning specimens of rock from a ravine on l'Eau qui Court has been prepared by Mr. W. P. Blake, and will be found in Appendix E.

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* The letter *a*, is always sounded as in *father*; *e*, as in *they*; *i*, as in *marine*; *ch* as in *cherry*.

The country north of White river is clayey; south of this stream it is sandy. This difference has an important bearing on roads through the two sections, as the former is almost everywhere impracticable in the wet seasons, while the latter is not materially injured by rain, and in some parts is improved by it. The water in the former is generally not constant, and wherever it stands in pools is frequently salt. The streams rise and fall suddenly, and their bottoms are more or less muddy and difficult to ford.

In the sandy region the rain that falls sinks into the surface and does not run off suddenly nor evaporate; pure water in small lakes, springs, and clear running streams are the consequence, but they are not numerous. The streams and lakes have sandy bottoms and are easy to ford.

The grass in the clay region, is, as a general thing, superior to that in the other, being finer and more nutritive; but along the banks of the streams, where the clay and sand in either region are mixed, there is not much difference. Wood generally exists along the banks of all the streams where it has not been destroyed by fire, or by the Indians for forage and fuel. Pine timber is found on l'Eau qui Court, on the southern branches of White river, and in the Black Hills. From my observation, I think that continuous settlements cannot be made in Nebraska, west of the 97th meridian, both on account of the unfavorable climate and want of fertility in the soil.

Grasshoppers occasionally devastate the country, stripping it in places of almost every green thing.

The *Black Hills* of Nebraska are believed to be composed of primitive rock, and are the eastern portion of the great mountain belt. They are in somewhat detached ridges, ranging NW. to SE. and probably have their continuation in Snowy, Bears Paw, and Little Missouri, mountains of the upper Missouri and the Cyprus mountains, &c., in the British possessions.

Bear Peak, between the forks of the Shyenne, as well as *Raw Hide Peak*, a little west of north from Fort Laramie, is a detached portion of this range, and both believed to be of primitive rock. All the other hills, peaks, or buttes to the east of these are stratified rocks, the remains of vast denudation. The rocky precipices and ridges on White river, between it and l'Eau qui Court, and on the Platte, are generally soft calcareous stone or marl, occasionally capped with hard grit.

The Bad Lands, (*les Mauvaises Terres*,) as generally understood, lie between the Shyenne and White rivers, and extend east along the latter stream as far as the forks. They belong to the tertiary period. Dr. Hayden thinks that the Bijou Hills are a part of the same formation; and I should think, from their appearance, the Dog's Ears and Turtle Hill also form a part of it. They lie in an extended ridge, coming from the direction of the Bad Lands of White river, and have similar lithological character. I did not, however, make sufficient examination to detect any fossil remains. Where the road passes through the Mauvaises Terres from White river to the head of Bad river, the surface is, in many places, covered with chalcedony, and is hard; in others it is clay, and in wet weather very soft. Through

this section some of the streams have clayey beds, some of them sandy. The precipitous ridges of the Mauvaises Terres are about two hundred

Scenery in the Bad Lands, (les Mauvaises Terres,) Nebraska.

feet high, and are very striking in appearance. (See sketch.) Black tailed deer and big horn are to be found here.

The Sand Hills (*les Buttes de Sable*) present their most characteristic appearance just north of Calamus river, spread out in every direc-

Scenery in the Sand Hills, (les Buttes de Sable,) Nebraska.

tion to the extreme verge of the horizon. (See sketch.) The sand is nearly white, or lightish yellow, and is about three fourths covered

with coarse grass and other plants, their roots penetrating so deep that it is almost impossible to pull them out.

The sand is formed into limited basins, over the rims of which you are constantly passing up one side and down the other, the feet of the animals frequently sinking so as to make the progress excessively laborious.

The scenery is exceedingly solitary, silent, and desolate, and depressing to one's spirits. Antelope, and at sometimes buffalo, are numerous. This is the common war ground for the Dacotas, Crows, Omahas, Poncas, and Pawnees. The character of the country is well calculated to cover a stealthy approach or retreat, and if one keeps as much as possible to the hollows he may even fire his rifle within a quarter of a mile of an enemy's camp without the faintest sound reaching it. Two parties may pass close without being aware of each other's presence, and I consider it hopeless to attempt to capture any who had sought refuge in the Sand Hills. Further west, these hills, I am told, increase in height, and are impassable for horses. Their east and west limits are not well known, but they undoubtedly occupy nearly all the country between Loup Fork and l'Eau qui Court, and form a lasting barrier to any direct economical wheel communication between them. Their width where we crossed is sixty miles. The country lying between the Republican Fork of the Kansas, and the South Fork of the Platte, described by Captain Fremont, (*Senate Doc. No.* 174, 2*d sess.* 28*th Congress*, *pp.* 109, 110,) is most probably a similar region.

The *Coteau du Missouri*, in Minnesota, has a soil of only two or three inches, beneath which is the gravel, &c., of the boulder formation; it extends east nearly to the Vermilion river.

RIVERS.

The *Missouri* is the most important river as regards our dealings with the Dacotas. Flowing through the middle of their country, it furnishes us with a base from which, with short lines of march, we can reach almost any portion of their lands, and many of them have their permanent home upon its banks. My remarks upon it will be confined wholly to that portion below the mouth of the Shyenne, and which came under my own observation.

The bottom lands and some of the larger islands are from fifteen to twenty feet above low water, and rarely overflowed, though during the melting of the snows this sometimes happens. The wood on these bottom lands, from being large and dense, as in the State of Missouri, gradually becomes thinner as we ascend to the mouth of the Vermilion, and above this it generally is only a narrow belt, varying from a single tree to groves half a mile in width, alternating on either side, or occupying a few of the larger islands; sometimes these, as Farm island, below Fort Pierre, and the large island below the mouth of the Shyenne, contain prairies in their interior. I believe, however, that timber sufficient for the wants of a military post exists everywhere within reasonable distance on the Missouri, as high up as the Big Shyenne, and above this the timber is said to improve.

The bottom lands on the Missouri, along the western boundary of Iowa, as well as the prairie lands on either side, are very fertile. The valley of the Big Sioux, above its mouth, forms the continuation in direction of that of the Missouri below, and is said to be fertile. The Hupan Kutey prairie, lying between this stream and the Vermilion, is low and fertile, and is about the last of the continuous fertile country as you advance up the Missouri, which here comes from the west. Above this the bottom lands of the Missouri are sometimes one and two miles wide, and will give but precarious support to an agricultural people; it is doubtful whether even this can be said of the high prairie lying back from the stream. On both sides of l'Eau qui Court, at its mouth, is a little of very beautiful country, and the Poncas raise considerable corn in this neighborhood, and winter here; it would furnish a handsome site for a military post. The same is true of the right bank of the Missouri, from White river to the Great Bend, at the former situation of old Fort Aux Cedres and Fort Look-out. Another eligible site is on the point ten to fifteen miles below the Shyenne. It is my opinion that no point above the Vermilion could be relied upon for many years to come to raise corn for the support of a cavalry post; above this it must be transported.

The crossing of the Missouri at low water is very difficult by any means. It cannot easily be forded, and shoals would prevent a boat from floating across, except she be of very light draft and small dimensions. I am convinced, however, from what I have seen during a season of unparalleled difficulties to navigation, that, with suitable preparation, the Missouri can always be relied upon as a channel to convey any necessary amount of supplies. The removal of some of the snags and boulders would greatly improve it, but even as it is, with a better knowledge of the channel on the part of those navigating it, and more suitably constructed boats, this stream would lose much of its terror to them.

L'Eau qui Court, during floods, throws out large quantities of sand, and leaves a bad bar in the Missouri. Another bad bar exists just below the mouth of White river, and some boulder obstructions are found in the Great Bend.

The wood used by steamboats above the mouth of the Big Sioux is cut by their crews as they proceed, and, consequently, only dead trees will answer. Such wood is most often in places inaccessible for steamboats in moderate stages of the river, and hence the great scarcity of it that is complained of. There is, nevertheless, wood enough for steam navigation for many years, and no scarcity would be felt if there were men to cut it in the autumn, and haul it to good landings in the spring.

My trip was made in the steamboat Clara, drawing $5\frac{1}{2}$ feet of water. She had to be lightened at the mouth of l'Eau qui Court, and again at the bar above the mouth of White river, and at the foot of the Great Bend. She was 39 days from St. Louis to Fort Pierre.

The Clara was so hard to handle when the wind blew strong, that she frequently could not be kept in the channel. The requisites of a good steamboat for Missouri navigation are, a strong bottom, a boiler that burns the minimum amount of wood, as little as possible of top

hamper, wheels well forward, and considerable breadth of beam, so as to give as much control over her motions as possible. The Clara was the reverse of all this, but Captain Cheever, her commander, was a most skilful river man, and his untiring efforts overcame all difficulties.

The main rise on the Missouri occurs between April 20, and June 1.

The *Platte river* is the most important tributary of the Missouri in the region under consideration; its broad and grass-covered valley leading to the west, furnishes one of the best wagon roads of its length in America. From its mouth to the forks, the bluffs are from two to five miles from the water, making an intermediate bottom valley of from four to eight miles wide. From the forks to Fort Laramie, the bluffs occasionally come down to the water's edge, and the road has to cross the points of the ridges. From Ash Hollow to Fort Laramie, the road is sometimes heavy with sand. Fine cotton wood grows along the banks, and on the islands, from the mouth to Fort Kearny; from here up it is scarce, and of small size. Cedar is found in the ravines of the bluffs, in the neighborhood of the forks, and above. The river is about a mile wide, and flows over a sandy bottom; when the banks are full, it is about six feet deep throughout, having a remarkably level bed; but it is of no use for navigation, as the bed is so broad that the water seldom attains sufficient depth, and then the rise is of short duration.

The water is sometimes so low, as was the case last season, that it can be crossed anywhere without difficulty, the only care requisite being to avoid quicksands.

The manner in which this stream spreads out over its entire bed in low water, is one of its most striking features, and it is peculiar to the rivers of the sandy region. A short distance above Fort Laramie, the Platte comes out from among the gorges and cañons, and its character there is that of a mountain stream.

Loup river, a large branch of the Platte, some 200 yards wide, is, where I saw it, in every respect similar to the latter below the forks, and a fine road could, without doubt, be made along its valley, which is about two miles wide. Its banks are low, like those of the Platte, but are much better wooded. The Pawnees lived in numbers on this stream, till the hostility of the Dacotas drove them from their homes. I have no knowledge of how far west this stream heads, but judge from its size that it must be about the meridian of Ash Hollow. It drains a portion of the Sand Hills, and has several large tributaries.

L'Eau qui Court or *Rapid river* has its source just west of Rawhide Peak, about twenty-five miles north of Fort Laramie, and flows for the most part through a sterile country. Where I crossed it, August 15th, it was about 200 yards wide, the banks one hundred and forty feet high, and the river difficult to approach. High precipices of soft, calcareous sandstone stood in places at the water's edge. The valley was very narrow, and it was impossible to course along it without frequently taking to the ridges. The water was clear and flowed swiftly over a sandy bed. In the side ravines, which are all filled with pine or scrubby oak, are numerous springs. The stream

might answer for rafting in the floods, but would furnish no navigation.

White river rises about 35 miles east of the source of Rapid river, and in about the same latitude. Its course for the first 15 or 20 miles is through a narrow gorge, thence it emerges into a broad, open valley, through which it flows for 90 miles, and then enters the high, precipitous cliffs of the Bad Lands; it winds through these to the South Fork, and thence to its mouth it has a beautifully wooded and grassy valley of about one mile wide. Below the Bad Lands, its valley cannot be followed without frequently taking to the high prairie bluffs. At the forks, the river is about 140 yards wide; a short distance above the mouth, about 200 yards. The south fork has large pines upon it, and so have most of the southern branches above this stream, and they are much resorted to by the Indians. The water from these streams is clear, and similar to Rapid river.

The Bad river, Wahpa Shicha, Teton, or Little Missouri river, is about 90 miles long, rising just east of the Bad Lands. The same difficulty is experienced as with the lower part of White river, if you attempt to follow along its valley. The valley is from one-half to one mile wide, well grassed and wooded. The bed of the stream is soft and miry, and generally not fordable. The approach to the valley is not difficult for wagons in dry weather. Cottonwood exists in considerable quantities mixed with willow, and in some places, ash and oak. Wild plum trees are abundant. A portion of this valley is adapted to raising Indian corn. When flooded, the river is from 25 to 40 yards wide, and cannot then be crossed without a good bridge or ferry. I am not informed of the extent to which it overflows its immediate banks, which are about 10 feet high. This stream flows through a section abounding in salt springs, and salt incrustations are almost everywhere visible, but the water is generally palatable.

Big Shyenne, Washté Wahpa or *Good river*, rises west of the Black Hills. The north fork, it is said, breaks through, as in the case of Laramie river. The forks are about 100 miles from the mouth. The south fork rises not far from the source of l'Eau qui Court. After leaving the Black Hills this stream flows between high clay bluffs, winding about in its valley, and is in many respects similar to White river and Bad river, being difficult to pursue with wagons. The stream near its mouth is about 200 yards wide, the bottom is generally muddy, and not easily crossed. Fine cottonwood exists along its banks, and pine on its sources in the Black Hills. The stream could be used for rafting.

The Rivière à Jaques, or *James river*, rises near Mini Wakan, or Devil's lake, in latitude 47° 30′ north, and flows through a valley about one mile wide, the stream in the lower part being 80 yards wide. It entirely overflows its valley at high water, and must then be ferried. There is a rapid formed by boulders nearly in the direct line from Sioux city to Fort Pierre, which makes a good crossing when the river is low. Below this, loaded wagons cannot cross without a bridge or ferry. Canoes can navigate this stream at all times, and steamboats could go a long way up at high water. There is not

much wood on its banks, and the country bordering is not valuable for agricultural purposes, and posseses few resources.

The Vermilion has a good ford nearly in a direct line from Fort Pierre to Sioux city, the stream being about 20 yards wide; below this point it is difficult to ford. The valley is broad and not all overflowed.

There is some timber along its margin, and the country adjoining is fertile. I consider it about the western limits of agricultural lands.

The Big Sioux is a fine large stream, about 150 yards wide at its mouth; the water is from two to three feet deep in low stages; bottom muddy, and not fordable. The soil of the land bordering it is good and productive, and the stream is fringed with cottonwood. It will no doubt be valuable for steamboat navigation. A ferry is being established at its mouth.

ROUTES, TRANSPORTATION, &c.

From Fort Leavenworth to Fort Kearny there is a good prairie road, with a ferry on the Blue river. The road from Fort Kearny along the south side of the Platte to the crossing of the south fork, is perfectly level and well broken; the ground, a few inches below the surface, is gravel or sand, and ordinary rains do not seriously affect it. In crossing the divide from the south fork to the north, we gain the summit by easy slopes, but the descent is very sudden into Ash Hollow on the north fork, and it would be almost impracticable to take a loaded wagon up this steep. Ash Hollow is bounded on all sides by rocky escarpments from 50 to 100 feet high, and much labor would be required to make a permanently good road for getting down to it. The route this far is the one usually followed by the emigration which leaves the western part of Missouri for Oregon and California, and it continues usually along the south side of the north fork to Laramie river, which is crossed by a good bridge.

We crossed the north fork at Ash Hollow, and passed up on the north side, which is probably preferable when the river is low enough to be easily crossed. The Mormon emigration, and that which leaves the vicinity of Kanesville, Iowa, I am informed, strikes across the country to the Platte, follows this to the mouth of Wood river, then up this stream to near its source and crosses to the Platte again in the vicinity of Big Cottonwood Spring, and continues on the north side all the way to Fort Laramie. This route has to cross the Elk Horn, a stream about 30 yards wide, and Loup Fork, 200 yards wide, which, when flooded, must be ferried over, and perhaps might not be passable for many days at a time. This route, I am informed, is quite heavy and difficult during wet seasons. If it should be used to supply Fort Laramie the stores would have to be crossed over the north fork of the Platte, but at a point so near the Fort that they might be left on the north side in charge of a detachment from the garrison. The route along the south side of the Platte has at least to cross the south fork, which, in the time of melting snows and spring floods, would occasion serious delay. I am not, therefore, prepared to say whether Fort Laramie could be best supplied from Fort Leavenworth, or from the

points of starting of the Mormon emigration near Florence, above the mouth of the Platte; the distance of land transportation is in favor of the latter. The scarcity of wood along the Platte is a serious objection to winter travel. The bottom, along which the road lies, is very seldom overflowed. I think it altogether probable that a good route could be found leading up Loup Fork towards its source, and then crossing over to the Platte—it should be examined.

It was thought that the route from Fort Pierre to Fort Laramie might be used to supply the latter post, the stores being transported by steamboats up the Missouri. I believe the steamboat transportation perfectly practicable up to Fort Pierre for any requisite amount of provisions and stores, yet they could not be relied upon to reach there before the 15th of July, and the cost would be considerable. The land transportation would then be 323 miles. But the road, even in good seasons is rough and contains numerous hills, requiring heavy hauling, and in wet seasons would be almost impassable, as it lies throughout in a clay region. For 12 miles on the head of White river, the road is in the last degree bad at all times; there is reason, however, to think that this portion could be avoided. But when we consider that the train for transportation from Fort Pierre to Fort Laramie must be procured from the States at a distance of 500 to 600 miles, it is doubtful if at any time economy would select this route as a channel through which to supply Fort Laramie.

Very much in the same light must we view the project of supplying Fort Laramie from the mouth of Rapid river, supposing a post established at that point, viz: the distance one hundred to four hundred miles, from which the means of land transportation must be obtained and the probable difficulties of the route itself. This proposed road would have to keep on the divide north or south of Rapid river, and most probably to the north, or if it entered the valley would be forced to cross the stream frequently, or take again to the bluffs. Unlike the Platte, or the main portion of White river now followed by the Pierre and Laramie road, the Rapid river has no continuous broad valley on either side, and could not be followed by wagons at the points at which I have visited it. A better route would no doubt be found along the valley of Turtle Hill creek, a branch of l'Eau qui Court, to near its head; it must then take along the divide between White and Rapid rivers, of the nature of which I am not informed.

Wood will no doubt be found on all the streams along this route, but we should have to make frequent detours to find camps if we are confined to the divide.

The country is sandy and the road would be good in wet weather: there is undoubtedly good grass.

The route from Fort Pierre to Fort Kearny in summer answers very well for light vehicles or pack trains, and wood, water, and grass are sufficient for travelling purposes: the large streams, however, that have to be crossed, and which, when flooded, would occasion delay, as well as the difficulties of the sand hills, render this route unfit for more than the ordinary communications between posts.

The direct route from Sioux City to Fort Pierre, by the way of Fire Steel creek, is very good; there is a ferry at the mouth of the Big

Sioux, and a good ford in low stages across the Vermilion and James rivers. Scarcity of fuel is a serious objection to winter travel. A better route in cold weather, or when the streams are flooded, though somewhat longer, lies nearer the Missouri, crossing the Vermilion and James rivers at their mouths, and at these two places ferry boats should be provided.

I have no special information concerning the route from Fort Pierre to Fort Ridgely; it is probably good and very direct, but James river cannot be forded if it is high. The road from Fort Pierre, direct to the mouth of Shyenne river, forty miles, is very bad in wet weather, and almost impassable for wagons. The road leading to the American Fur Company's trading house, on the Moreau, crosses the Shyenne about twenty miles from its mouth, and is bad in wet weather, though not so hilly as the other, as it avoids the side ravines of the Missouri.

Detail directions for travelling on the routes between Fort Pierre and Fort Kearny, between Fort Kearny and Fort Laramie, between Fort Laramie and Fort Pierre, and between Fort Pierre and Sioux city, will be found at the end of this report.

A good road could be had from near the mouth of the Platte to the mouth of l'Eau qui Court, following the Elk Horn river; it has been used by the American Fur Company, but I have no definite information concerning it.

INDIANS AND MILITARY POSTS.

The *Dacotas* occupy most of the country we have been considering, and are scattered over an immense territory, extending from the Mississippi on the east to the Black Hills on the west, and from the forks of the Platte on the south to Devil's Lake on the north. "They say their name means leagued or allied," and they sometimes speak of themselves as the "Ocheti Shaowni," or "Seven Council Fires." These are the seven principal bands which compose the nation, viz:

"1. The *Mde-wakan-tonwans*, meaning village of the Spirit lake."

"2. *Wahpekutes*, meaning leaf shooters."

"3. *Wahpe-tonwans*, meaning village in the leaves."

"4. *Sisi-tonwans*, meaning village of the marsh."

These four constitute the Mississippi and Minnesota Dacotas, and are called by those on the Missouri "*Isanties*." They are estimated at 6,200 souls. Some of these are said to give much trouble to the settlers in northwestern Iowa and in Nebraska, and are charged with outrages during the past season. Fort Ridgely is in their country.

5. *The Ihanktonwans*, village at the end, (Yanktons,) sometimes called Wichivela or "First Nation."

They are found at the mouth of the Big Sioux, and between it and James river, and on the opposite bank of the Missouri. They are supposed to number 360 lodges. Contact with the whites has considerably degenerated them, and their distance from the present buffalo ranges renders them comparatively poor.

6. *The Ihanktonwannas*, one of the "end village" bands, (Yanktonais) range between James river and the Missouri as high north as Devil's Lake. They number 800 lodges, and are spirited and warlike.

They fought against the United States in the war of 1812, and thei chief went on a visit to England. "From the Wazikute branch o this band the Assinniboins, or Hohe of the Dacotas, are said to hav sprung."

7. "*The Titonwans, village of the prairie*, are supposed to constitut more than one-half of the whole Dacota nation." They live on th western side of the Missouri, and take within their range the Blacl Hills from between the forks of the Platte to the Yellowstone river

They are allied by marriage with the Shyennes and Aricarees, bu are mortal enemies of the Pawnees. The Titonwans, except a few o the Brulés on White river, and some of the families connected witl the whites by marriage, have never planted corn. They are divide into seven bands, viz:

1. *Unkpapas, they who camp by themselves.* They live on the Mis souri near the mouth of the Moreau, and roam from the Big Shyenn up to the Yellowstone, and west to the Black Hills. They formerly intermarried extensively with the Shyennes. They number about 36 lodges.

2. *Sihasapas, Blackfeet.* Haunts and homes same as the Unkpapas number 165 lodges. These two bands have very little respect for th power of the whites.

3. *Oo-he-non-pas, two boilings or two kettle band.* These are now very much scattered among other bands. They number about 10 lodges.

4. *Sichangus, burnt thighs, Brulés*, claim the country along Whit river and contiguous to it. They number 480 lodges. They includ the Wazazhas, to which belonged Matoiya, (the Scattering Bear made chief of all the Dacotas by the government, and who was kille by Lieutenant Grattan.

5. *Ogalalas, they who live in the mountains*, live between the fork of the Platte, and number 360 lodges.

6. *Minikanyes, they who plant by the water*, live on and between th forks of the Shyenne and in the Black Hills; number 200 lodges.

7. *Itahzipchois, Bowpith, Sans Arc*, claim in common with th Minikanyes, and number 170 lodges. These last two bands hav been exceedingly troublesome to the emigration.

The Dacotas, on and west of the Missouri, which includes all but the Isanties, are the only ones I have heard estimated. I should think that eight inmates to a lodge, and one-fifth of them warriors, an ample allowance. We would then have:

	Lodges	Inmates.	Warriors
Ihanktonwans, (Yanktons)	360	2,880	572
Ihanktonwannas (Yanktonais)	800	6,400	1,240
Unkpapas	365	2,920	584
Sihasapas, (Blackfeet)	165	1,280	256
Oohenonpas, (Two Kettle)	100	800	160
Sichangus, (Brulé)	480	3,840	748
Ogalalas	360	2,880	576
Minikanyes	200	1,600	320
Itazipchois, (Sans Arc)	170	1,360	272
Total	3,000	24,000	4,800

These Dacotas formerly all lived around the headwaters of the Mis-

l river of the north, and in their migration to the ... pushed the Shyennes (with whom they are on friendly terms) in advance, leaving their name to the Shyenne of Red river, to the Big Shyenne of the Missouri, and to the section of country they now occupy between the Platte and the Arkansas.

In the summer the Dacotas follow the buffaloes in their ranges over the prairie, and in the winter fix their lodges in the clusters or fringes of wood along the banks of the lakes and streams. The bark of the cottonwood, which furnishes food for their horses during the winter snows, have led to immense destruction of this timber, and many streams have been thinned or entirely stripped of their former beautiful groves.

Their horses are obtained by traffic with the Indians further south, who have stolen them in New Mexico, or are caught wild on the plains towards the Rocky mountains. The nation is one of the most skilfull and warlike and most numerous in our Territory; and could they be made to feel a due confidence in their own powers, would be most formidable warriors. In single combat on horseback they have no superiors—a skill acquired by constant practice with their bows and arrows and long lances, with which they succeed in killing their game at full speed. The rapidity with which they shoot their arrows, and the accuracy of their aim, rivals that of a practiced hand with the famed revolver.

Notwithstanding the destruction of their numbers by small pox and cholera, it is the opinion of some that they are increasing in numbers rather than diminishing, except where they mingle with the settlements on the frontier. It has been well said that theft is an Indian virtue.

The love of renown and desire for plunder leads them far from their homes, and many of the depredations along the Platte are committed by the Unkpapas and Sihasapas, whose homes are further from it than those of any of the Titonwans. The Isanties or Dacotas of the St. Peter's also carry their ravages into Nebraska, and are there the most dreaded of all the savages.

When any redress or reparation is sought, or punishment threatened for these offences, the same excuse is always made: "The old men opposed it, but the young men could not be restrained." So long as the smiles of the females, the admiration of his comrades, and ultimate influence with his tribe continue to be the reward of daring exploits, these, to say nothing of the Indian's often absolute necessities, will prove too strong in the breast of the youthful warrior for the counsels and frowns of age, or for the peaceful policy of the Indian Bureau.

Military occupation is essential to the safety of the whites, and the military posts should be in such positions, and occupied by such numbers, as effectually to overawe the ambitious and turbulent, and sustain the counsel of the old and prudent.

They should be placed well in the country whence the marauders come, as well as on the frontiers and lines of communication they are designed to protect. In making this occupation we should look to the future. Agricultural settlements have now nearly reached their

western limits on our great plains; the tracts beyond must ever be occupied by a pastoral people, whether civilized or savage. If the Indian is not doomed to speedy extirpation, if he is to have a permanent home, here is where it must be located, and the military posts should contemplate a permanency which they have not heretofore possessed.

Posts situated near the Indians' homes, designed to restrain, might be garrisoned by infantry, and they should be large from the outset, to command immediate respect. Those situated near the settlements for protection should be cavalry, both on account of the facility with which they can move to threatened points, or pursue the offenders, and for the comparative ease with which the horses could be maintained during the winter, and be ready for early and efficient service in the spring.

With good commanders, and forces sufficient to sustain them in the measures they may take for chastising or restraining the Indians, and protecting them from the injustice of the whites, peace can be maintained without exterminating the red man, whose manliness has much to admire, and whose fate deserves our sympathy.

Upon the principles I have mentioned, I should recommend that an infantry post be maintained in the neighborhood of Fort Pierre. Of all the points yet occupied in the Dacota country this is the most central. Good prairie roads lead from it in every direction, and the experienced guides and traders of the American Fur Company have explored them all. Formerly, it was no uncommon thing to see six hundred lodges camped around this fort at one time. A spot to which so many could assemble must be no unimportant one from which to pursue them to their homes. A navigable river leads direct to the place, and the post can be supplied with certainty, if proper preparations are made. I have the opinions of the most successful steamboat captains to this effect.

A permanent establishment here, with the occasional movement of troops between it and Fort Laramie, must entirely drive the disaffected and dangerous Dacotas from all the country south of this route.

Another post of, say four companies, should be kept up at the mouth of l'Eau qui Court to restrain the Poncas.

A cavalry post should be established in the neighborhood of the mouth of Big Sioux river, as protection to the settlements in Iowa and Nebraska from the Ihanktonwans and Isanties, and co-operate with the troops at Fort Pierre. Forage could be economically procured at this point, and it is probably the most western in this latitude, or north of it, that horses could reasonably be maintained so as to be prepared for an early spring campaign.

Future necessities may require the establishment of a post near the Moreau river, among the Unkpapas, or on the left bank in the country of the Ihanktonwannas.

On the line of the Platte, Fort Kearny must, for a long time, be beyond the frontier settlements, and is a necessary post for the protection of emigrants.

Fort Laramie will always be in the Indian country as long as there is one, and makes a most valuable point for protection to travel.

West of Fort Laramie temporary protection should be afforded, when necessary, by patrols and escorts, and also between Forts Laramie and Kearny.

Not less than one regiment, four companies, at Fort Kearny, and six at Fort Laramie should be kept on this line.

A winter campaign could not often be made with success in the Dacota country, and all that should be attempted is to preserve the men and animals for early spring operations, when the emaciated condition of the Indian horses would prevent them escaping and insure their easy capture.

The present war should not be abandoned until the Unkpapas, Minikanyes, and Ihanktonwannas have felt or acknowledged the power of the general government, and be made to entertain for our citizens a feeling of respect, in which they have heretofore been sadly wanting. If active operations are to be carried on during the coming season in the Dacota country, it is against them the forces should be directed, from both Fort Laramie and Fort Pierre.

The punishment inflicted on the Brulés and Ogalalas at Blue Water has taught them a useful lesson, which they will not soon forget.

The Pawnees, about eight hundred warriors, with whom the Dacotas are at war, and the Poncas, three hundred warriors, with whom they are friendly, occupy the southeastern part of Nebraska; to the southwest are the Shyennes, one thousand, between whom and the Ogalala Dacotas the most friendly relations exist. The Crows, a powerful and warlike tribe, occupy the country between the Black Hills and Wind River mountains, about the sources of the Yellowstone. They made a treaty of peace with the Dacotas at Horse creek, in 1849, but they are enemies at heart. The small bands of Mandans, Aricarees, and Minnitares, and the powerful one of the Assinniboins, are on the north.

CONCLUSION.

Very little is known as to the accurate geography and topography of the Crow country and Black Hills, and, in fact, of any portion of Nebraska west of the Missouri, and the road from Fort Pierre to Fort Laramie.

The same causes that brought on the war with the Sioux will, no doubt, continue to operate, and the time is not distant when we shall have a similar necessity for chastising the Crows and northern Missouri Dacotas, who have, as yet, seen nothing of the power of the United States, nor feel any respect for it. It seems to me, therefore, in a purely military point of view, of the greatest importance to gain a knowledge of that region, while the peaceful disposition of these tribes may permit, and before they become maddened by the encroachments of the white man. It is, therefore, respectfully requested that a recommendation be made to Congress, through the proper channel, for an appropriation of $50,000, for military and geographical explorations in the territory of Nebraska.

A reconnaissance, which could be made at small expense on the Fur Company's steamboat, should be made of the Missouri river from Fort Pierre to the mouth of the Yellowstone; one should also be made

of Loup Fork of the Platte, and of the country between White river and l'Eau qui Court, for the purpose of seeking good communication between Fort Laramie and the Missouri river. Routes from Fort Laramie to the Yellowstone, and of the country around and between the forks of the Shyenne, deserve examination. The future necessities of Indian warfare will undoubtedly render information in this territory of the last degree valuable.

Accompanying this report is a map of a portion of the Dacota country, on a scale of 1 to 600,000. It embraces all the explorations within the limits compassed by it, including those of Major Long, J. N. Nicollet, Captain Fremont and Captain Stansbury. The sketches by Lieutenant Curtis of the route from Fort Pierre to the mouth of White river, and of Mr. P. Carrey, from Fort St. Vrain to Fort Laramie, were made with a pocket compass, and estimated distances—those made by myself, are with prismatic compass and odometer measurements of distance. Barometer observations were taken on the route from Fort Pierre to Fort Kearny, and thence to Fort Laramie; the observations and results are appended to this report. A barometric profile of the route from Fort Pierre to Fort Kearny is also given. From not getting my instruments in time, I was unable to make any astronomical observations. The latitude of Fort Pierre is taken from Nicollet, that of Fort Kearny, and the latitude and longitude of Fort Laramie, are taken from Captain Stansbury. The longitude of Fort Pierre and Fort Kearny are taken from the general map, which I compiled in the office of the Pacific Railroad Exploration, and are the result of comparison of several determinations.

The longitude of no point on this map, distant from the boundary of the States, can be considered certain within 5 to 10 miles. The surveys with the compass and odometer were very carefully made.

I also present another map on a scale of 1 to 300,000, giving the location of the different bands of Indians, and such other information as I was enabled to obtain from the hunters and trappers. Though it is not reliable where surveys have not been made, still it is the best that our present knowledge will permit. To the services of Mr. Paul Carrey, who accompanied me in the hazardous journey from Fort Pierre to Fort Kearny, I am much indebted, and also to Lieutenant Curtis, who furnished me with the sketch from Fort Pierre to the mouth of White river, and to Lieutenant Balch for his voluntary assistance on the route from Fort Laramie to Fort Pierre.

For information about portions of the country I have not visited, I had the benefit of frequent consultation with Colon Campbell, Michael Desomet, Jean Lefebre, James Boldeaux, Joseph Jewitt, James Baker, Dr. Hayden, Mr. Galpin, Henry Goulet, Alexander Culbertstone, and others, whose statements I have endeavored to combine.

To Mr. J. Hudson Snowden, who assisted me in the meteorological observations, and in working out the results, nearly all the merit is due which they may possess. These observations and results, with notes on the weather on all the routes travelled, are annexed to this report, under the head of meteorology.

A number of skins of birds were collected, among which were the

western rough legged hawk, (*Archibutes ferrugineus*,) from the Teton or Bad river, in longitude 102°, and the white-headed avoset, (*Recurvirostra occidentalus*,) from the north fork of the Platte, in longitude 103°. The first of these has hitherto only been found near the Pacific coast; and the latter has been considered as peculiar to the regions west of the Rocky mountains; its occurrence in New Mexico, near Santa Fé, is recorded in Captain Stansbury's report as something remarkable.

It is, perhaps, proper to allude here to the journey performed from Fort Pierre to Fort Kearny, since nearly all the knowledge I have gained, and whatever service I may have rendered, resulted immediately from it.

When I was preparing for the undertaking, and had secured a party of six persons, exclusive of Mr. Carrey and myself, I was counselled most earnestly by my brother officers not to make it, and the commanding officer at Fort Pierre thought seriously of interposing his authority as my military superior to prevent so "rash" an attempt, which presented to him nothing but a prospect of my certain destruction. The route was known to lead through the country of the Brulés, (supposed to be our worst enemies,) and nothing was known as to their position or intention. We would, also, it was said, meet the Poncas and Pawnees, and neither would hesitate to rob, or even "wipe out" a party as small as mine, well knowing the offence would be charged upon the Brulés. Moreover, much of the route was wholly unknown and untravelled, and there was no estimating the obstacles and delays we might encounter. My intention, however, had not been formed without due consideration of these things, and careful conversation with the men of the country. The weather was as yet too warm, it being the first of August, for the war parties to have formed, and it was the season for making "sweet corn," so that the Indians would likely be thus engaged. The party was made up of the most experienced prairie men, four of them being half-breed Dacotas, and we were well armed; we were determined to be constantly on our guard, and to travel in the night if we came in the vicinity of an enemy; no fire was to be lighted at night, nor tent pitched. Mr. Galpin, of the Fur Company, assured me he did not believe I would meet an Indian, and the result verified his prediction. We saw fresh trails of the Poncas on l'Eau qui Court, and of the Brulés in the Sand Hills, and some deserted Pawnee camps on Loup Fork, but no Indians. We performed the journey in fifteen days.

I was thus enabled to carry out the instructions under which I had gone to Fort Pierre to participate in the campaign under General Harney, and perform the duties required of me as topographical engineer of the expedition.

I hope this explanation will free me from any charge of having acted with rashness or imprudence.

The general conclusions which I have drawn from my own observations and studies (though I may not have fully demonstrated them) are, that the portion of Nebraska (which I have visited) lying north of White river is mostly of a clay formation, and that south of it is mainly of sand; that but a small portion of it is susceptible of culti-

vation west of the 97th meridian; that the Territory is occupied by powerful tribes of roving savages, and is only adapted to a mode of life such as theirs; that it must long remain an Indian country; that the Indians should be made to feel the power of the United States; that the military posts, in consequence, should contemplate permanency; that Forts Laramie and Pierre are the most important positions yet occupied; that the latter can always be supplied by steamboats on the Missouri; that the former must be supplied by way of the valley of the Platte; that a great deal yet remains to be learned of this vast territory; and that it is of the utmost importance to acquire a thorough knowledge of it without delay.

I have the honor, sir, to be, very respectfully, your obedient servant,

G. K. WARREN,
Lieutenant Topographical Engineers.

Brevet Brig. Gen. W. F. HARNEY,
U. S. army, commanding Sioux expedition.

APPENDIX A.

DETAILS OF ROUTES.

Latitude, longitude, altitude, and magnetic declination.

APPROXIMATE.

Place.	Latitude.	Longitude.	Altitude.	Mag. var. east.
	° ′	° ′	*Feet.*	° ′
Fort Ridgely	44 35	95 07	1,000	10 00
Sioux City	42 32	96 26	1,250	11 30
Fort Kearny	40 38½	99 06	2,000	13 45
Fort Pierre	44 23½	100 24½	1,504	14 00
Fort Laramie	42 12½	104 31½	4,250	15 00

Description of route from Fort Pierre to Fort Kearny.

NOTES.

	Distance from Fort Pierre.
Fort Pierre, situated on a high bottom land on the right bank of the Missouri river—grass very scanty, there having been no spring rain. Left Fort Pierre, August 8, 1855.	
Road is over the bottom land—a dark, sticky, clay soil, with sage growing upon it, for two miles; then crosses a high, narrow, dark, clay ridge to Bad river, at a good ford, with rocky bottom. When flooded, must be ferried, 4½ miles -	4½

Distance from Fort Pierre.

Bad river—*Wakpa Shicha*—is sometimes called Little Missouri, sometimes Teton river---wood and grass fine.

August 9.—Road over high rolling prairie; crosses the sources of Antelope river and Cedar river, to east branch of Medicine river. After passing the divide of Bad river, soil good, with fine grass. These streams in dry times generally contain water in holes, and have small cottonwood and willow on their banks, furnishing fuel. They are from 10 to 20 feet wide, and their banks from 4 to 5 feet high. When occupied with running water, bed will be found muddy, and should be crossed carefully. From Bad river to Antelope river, 9½ miles - - - - 13¾

Thence to Cedar creek, 9½ miles - - - - 23¼

Thence to East branch of Medicine river, 10 miles - - 33¼

August 10.—Crossed Medicine river just below the forks, saw here a fresh track of a buffalo bull, 2 miles - - - 35¼

About 5 miles further on we gain the divide between Medicine and White rivers—soil is now rather poor, and the ridge contains some small lake beds, which have water in the spring season - - - - - - 40¼

From this ridge, looking south, the whole horizon south of White river is occupied with high broken prairie ridges and peaks. We keep on this high lake ridge about 4 miles, and descend a line of bluffs, along the foot of which are the sources of the side branches of White river; thence to White river, 8 miles - - - - - 52¼

The road to-day was good—grass rather thin, and no wood nor water.

August 11.—White river—*Mankisita W.*—High from recent rain, but falling. Spent the day examining up and down the stream, and forded it in the afternoon. This ford is a fair one, with rocky bottom, but it must be carefully examined on foot before crossing, and every animal should be led or ridden over, as the least wandering from the proper course may mire it inextricably. The stream is now 480 feet wide, water muddy, of a white color, 1 to 3 feet deep, its immediate banks some 5 feet higher. We forded it at the highest stage of water practicable, if higher it must be ferried. The valley is about one mile wide, and nearly all overflowed in freshets. The bluffs are 100 feet high, and loaded wagons could ascend and descend without difficulty. Fine cottonwood of large size grows on the banks, though much thinned out by the Indians. Grass grows luxuriantly, and elk, deer, and antelope may be found in limited numbers. About 20 miles above this ford are the forks.

August 12.—Road over slightly rolling prairie. In about 2½ miles pass near Oak creek; thence 8½ miles to small branch of Two-tail creek, 11 miles - - - 63¼

Distance from Fort Pierre.

Here wood for fuel, and good grass; continuing on with Two-tail creek 1 to 2 miles east, over good route, to head of this stream, 9 miles - - - - - - 72¼

At this place the stream is 15 to 20 feet wide, water in holes, bank 5 to 10 feet feet high, bottom generally sandy, grass good in spots, cottonwood, oak, and willow, good size. Near here is a large prairie-dog village. They have thus far been numerous, but these were the last we saw till we reached the Platte river. The soil is now becoming sandy. High table-land ridges were about 5 miles to the west, said to have springs at their base, and here Two-tail creek has its source.

August 13.—Route good to a head branch of Dog's Ears creek, 14½ miles - - - - - - 86¾

Here clear spring water in considerable quantity, good grass, but no wood; some trees flourish 2 to 3 miles further down. The soil has now become exceedingly sandy, but generally covered with grass. On the ridges a soft calcareous sandstone crops out, and we are now in the region that gives character to the distant view to be had from the northern divide of White river. These ridges have a general southeast direction.

The Dog's Ears hills,(*Les Buttes des Oreilles de Chien,*) two small prominent hills of this sandstone formation, lie about two miles to the east of us, and have served as a landmark since leaving White river. We now cross an easy divide, and enter the basin of White lake, a clear, beautiful little sheet of water, much resorted to by the Indians. The basin is very sandy, but covered with vegetation, and here we first meet with the *sand cherry*, the fruit being as large as the ordinary black cherry, which it resembles in appearance, but is not quite so sweet to the taste. The shrub when full grown, is 6 to 18 inches high, and so slender that its fruit bends it to the ground. Turtle hill, (*Keya Paha,*) of the same formation as the Dog's Ears, crowned with a few scattering pine trees, now serves as a landmark, toward which you proceed over rolling, grass-covered sand prairie, to Turtle Hill creek, 14 miles - - - - 100¾

This is a beautiful stream of clear water, about twenty yards wide, which, flowing over a sandy bottom, renders it easy to ford; the immediate banks are three to four feet high. Large and magnificent cottonwood grows on its banks, but the trees merely fringe the stream. Wild plums and cherries abound; the grass is excellent, and a small portion of its valley could be used for raising corn. This river is a favorite resort for the Indians, and those who live on the Missouri, near the mouth of Rapid river, usually course along it in going to and from the buffalo hunting grounds to the west; it heads near the source of the south fork of

Distance from Fort Pierre.

White river, and is a tributary to Rapid river. White lake lies about half-way from the Dog's Ears to Turtle Hill; there are a few trees on its banks; the beach is white sand. Tracks of buffalo bulls had now become frequent, and in White lake basin we saw a wild horse. - - - 100¾

August, 14.—Route passes along the right bank of Turtle Hill river for 6 miles, crossing a little branch with running water; gradually leaving the river we strike a branch 4 miles further on, with running water, but no wood, and pursue it to near its source; thence over sandy prairie to Rapid river, 24½ miles, all the way sandy; a little wild rice was seen. Rapid river—l'Eau qui Court, or Niobrara, is a name given it by the Ponca Indians; the Dacotas call it "Mini Tanka" or Big Water. It flows with a very swift current over a sandy bed, and between bluffs 140 feet high, which here approach each other so closely as to leave but a very narrow intermediate valley, not averaging one quarter of a mile. - - - - - 125¼

The stream is from 180 to 250 yards wide at the ford, 3½ to 4 feet deep in the deepest places, and the current so strong that it was difficult to keep one's feet; the intermediate bottom land is but 2 to 3 feet high, and must be overflowed in freshets; its passage in time of floods would require a ferry. Wherever the bluffs are worn by the stream, they exhibit vertical sections of a soft yellowish white calcareous sandstone, forming precipices 50 to 60 feet high; the same is the case with all the side ravines, which contain clear cool springs of water. All the ravines are filled with pine, (some of it 60 to 70 feet high,) scrubby oak and some ash; on the low bottom lands there is some little cottonwood. The approaches to the stream are very bad; the one we used was a well worn buffalo trail, showing that this crossing was one of no ordinary importance, yet, without a great deal of labor in preparing the road, it would be impossible to take a wagon by this route. A large party of Poncas had crossed here a few days previous, returning from the buffalo hunt to their corn fields at the mouth of the river.

August 15.—Followed along a well marked Indian trail, over sandy soil to the head of a side ravine of the *Wazi-han-skeya*, a tributary of Rapid river, 7 miles; water from a spring in the ravine; wood and grass good. *Wazi-han-skeya*, meaning "the place where the pine extends far out," is the name given to this stream, which is said to be twenty miles long, bordered with pine bluffs, in every respect similar to those of the river into which it flows. The Indian trail leads up this stream, and it was thought to furnish the best route in the direction we wished to go; but, as we were likely in pursuing it to meet war parties of savages, we determined to take the more direct and un-

Distance from Fort Pierre.

frequented route through the Sand Hills, though none of the party had ever been this way - - - - 132¼

August 16.—Travelled over rolling sand hills ten to forty feet high, increasing in height and abruptness as we advanced; clothed with grass and interspersed with sedgy lakes, having sandy bottoms, in some of which are small fish. There is no wood. Small willows, dry roots of the sand cherry, and wild rose, and "buffalo chips" furnished fuel in small quantities. Can camp almost anywhere near the small ponds. Saw several buffalo bulls, and antelope were thick. Days march 27½ miles. - - - 159¾

August 17.—Winding among the sand hills, which frequently forced us quite out of our course, and beginning to feel some anxiety as to what we were coming to, we suddenly emerged from them into the valley of Calamus river, 19 miles - - - - - - - 178¾

This is supposed to be a branch of Loup Fork of the Platte; its valley is 1½ miles wide, the stream about 20 yards wide, water clear, 1 to 3 feet deep, immediate banks about 4 feet high, easily forded; no wood exists where we crossed, but some was seen about 5 miles further down; grass luxuriant; travelled on and camped at a small pond in the sand hills; the sand hills to-day very bad; 4 miles - 182¾

August 18.—After winding through and over very bad sand hills for 12 miles. we suddenly issued from them into the broad valley of a stream, which was supposed to be a branch of Loup Fork. Travelling obliquely across the valley we reached the river, which, in the absence of any known name, was called Warren's fork. Fourteen and a half miles - - - - - - 197¼

This is a clear running stream, 150 yards wide, spread entirely over its sandy bed with a depth of from 1 inch to 3 feet; small cottonwood grows in patches along its banks, and the grass is luxuriant. The valley is 1 to 2 miles wide, and has a sandy soil, much of which could be cultivated. The stream does not, apparently, overflow its banks, which are now 3 to 4 feet above the water. Continuing our journey, crossing some dry, low, but steep ravines, we camped in a narrow ravine in the high prairie, which was of a clay formation, the sand having gradually disappeared since we left the sand hills; at camp, water in holes, and a few scattering cottonwood trees, 10½ miles - 207¾

August 19.—Proceeded over a good route to Pawnee river. Six and three-quarter miles - - - - 214½

Pawnee, Loup, or Wolf river, a branch of the Platte, is here 220 yards wide, spread out over its whole bed, and nowhere more than 3 feet deep. The water is clear and the bed sandy; the immediate banks about 4 to 8 feet high, and lined with medium sized cottonwood trees and willow.

Distance from Fort Pierre.

Its valley is from 2 to 3 miles wide, and the river is easy to approach and to ford at low stages.

As we travelled on we found the ridge south of Pawnee fork much cut up by ravines, and difficult to ascend, (quite impracticable at this place for wagons, and we ought to have gone down the stream 8 or 10 miles.) Having gained the ridge, our route was good, over high prairie, with some dry lake beds, and no wood nor permanent water to Muddy creek, 19½ miles - - - - - 234

Muddy creek here is a small running stream, twenty feet wide, with banks ten feet high, and steep, with muddy bottom, and is troublesome to cross; grass good; wood scarce, but plenty lower down. Fresh signs of buffalo now were abundant, and several bulls were seen to-day.

August 20.—Route led us over many secondary ridges and valleys, and was laborious for the animals.

After going 14 miles crossed Beaver creek, a small running stream, a little larger than Muddy creek, to which it is in every respect similar, but has considerable wood along its banks, and beaver dams in the stream. Continued on for 5 miles; camped at a poor water hole, with no wood; day's march 19 miles - - - - - 253

August 21.—Route to-day good. Reached in 12 miles a clear stream, fifty yards wide, with sandy bottom, banks from 4 to 10 feet high, and lined with cottonwood and willow; valley 1 to 2 miles wide, with luxuriant grass—named it, after Mr. Carrey, Carrey's fork; it is a branch of Pawnee river. After proceeding 1½ miles, crossed a wooded branch of the stream, with steep banks, 15 feet high, and difficult to ascend, and camped on a similar one 3½ miles beyond; water in holes; grass good; day's march 17 miles - 270

Several bands of buffalo cows were seen to-day.

August 22.—Route to-day was good; and just before reaching Wood river we passed through immense herds of buffalo, all running down the wind: landscape dotted everywhere with bands of cows and scattering bulls. Reached Wood river in 9¼ miles. This stream is about 30 feet wide, when full—now only 5 to 6 feet wide; banks 10 feet high, and require cutting; cottonwood lines the banks. A good route now opens to the Platte river, distant 10¾ miles, which we crossed at the head of Grand island, and proceeded to Fort Kearny, distant 11 miles; day's march 31 miles - - - - - - 301

The crossing of the Platte gave us no trouble, as it was no where more than 1 foot deep, and spread out over its bed, here a mile wide; the slough north of Grand island is about 30 yards wide; the banks of the Platte are 4 to 5 feet above the bed; the valley is 5 to 8 miles wide, and rarely overflowed.

Route from Fort Kearny to Fort Laramie.

Distance from Fort Kearny.

August 24, 1855.—Marched 10 miles over fine road, and encamped on the Platte; grass good; no road on south side of the river - - - - - -

August 25.—Road fine; buffalo numerous. Camped on the Platte; good grass, but no wood; day's march 19½ miles 29½

August 26.—Road fine; crossed Plum creek about 4 miles from morning camp; buffalo along the route; camped on the Platte; good grass, no wood; day's march 18 miles - 47½

August 27.—Road good: camped on the Platte near the foot of Brady's island; buffalo plenty; day's march 17½ miles 65

August 28.—Road good; camped at Cottonwood spring, a fine hole of cool water; no water in the Platte this side of the island; some little wood; cedar plenty on the bluffs south of the road; buffalo to-day all bulls; day's march 23¼ miles - - - - - - 88¼

August 29.—Road fine; camped at a water hole about 2 miles from the south fork; grass good; no wood; buffalo scarce and all of them bulls; day's march 18¾ miles - - 107

August 30.—Road good; crossed O'Fallen's bluff, (not high,) and camped about 2 miles beyond, on a slough: wood plenty: grass good; day's march 21 miles - - 128

August 31.—Road good: camped on the south fork; grass good; no wood; day's march 15½ miles - - - 143½

September 1.—Road to-day somewhat muddy from last night's rain; camped on the river; grass good; no wood; day's march 21¼ miles - - - - - - 164¾

September 2.—Reached crossing of south fork, 5 miles from morning camp; stream about 700 yards wide, crossing easy, water 18 inches to 2 feet deep; camped just above Ash Hollow on the north fork: grass thin; a little cedar wood on the bluffs; day's march 24¾ miles - - 189½

The descent into Ash Hollow is very steep, and much labor would be required to improve it permanently, as the slope is in part of rock. I examined the locality for a half a day, and found no place naturally superior to the one now used.

September 4.—Crossed the north fork, about 800 yards wide, with ease, water very shallow, and camped at the mouth of Blue Water creek, a clear running stream 15 yards wide at the mouth; grass good; no wood; day's march 3 miles - - - - - - - 192½

September 5, 6, 7 and 8—Were spent in recruiting the animals, reconnoitering, and constructing Fort Grattan, &c.

September 9.—Road fine; camped on the river; good grass; no wood; day's march 20¼ miles - - - 212¾

September 10.—About 8 miles from morning camp crossed a

Distance from Fort Kearny.

fine cool stream of water ; 8 miles further came to Ancient Ruins bluffs, which are so close to the river that we were obliged to go over the ridge ; the slopes are gradual, but on the west side the sand is thick ; road to-day in places heavy with sand ; camped on the river ; grass fine ; day's march 18¼ miles - - - - - - 231

September 11.—Road good ; river makes considerable bend and there is a fine grassed bottom between it and the road ; there were many deer in it ; we passed Court House rock on the south side ; camped on the river, with good grass, but no wood ; day's march 18½ miles - - - 249½

September 12.—To-day passed Chimney Rock on the south side of the stream ; the river forms here another large bend, making the road near the bluffs some 2 to 3 miles off ; there is another road not much longer, near the river, which is good in dry weather ; camped on the Platte ; grass good ; a little wood ; day's march 25¼ miles - - - 274¾

September 13.—After marching 12 miles, we came to a place where the bluffs approach close to the stream, and here is a fine spring creek with good grass and wood, extending along south of the road for 3 miles ; we passed on, and camped on a sedgy slough, with good water and grass, but no wood ; day's march 17¼ miles - - - 292

Road to-day good ; passed Scott's Bluffs about half way.

September 14.—Road good ; day's march 18 miles - - 310

Passed another fine spring creek, which runs parallel with the road, on the south side, for 4 miles, and camped on the river about one mile from the source of the creek ; grass tolerable ; some wood. The hay for Fort Laramie is cut at the head of this creek.

September 15.—Road to-day in places heavy with sand ; wood all along the Platte, but no grass ; crossed the dry sandy bed of Raw-hide creek, about 9 miles from camp ; camped opposite the mouth of Laramie river ; no grass ; day's march 25 miles - - - - - - 335

September 16.—Nearly all the animals were sent about 15 miles up the Laramie river to pasture, but even there grass was poor.

The distance from Ash Hollow to Fort Laramie, on the south side of the north fork, as given in Captain Stansbury's report, is 149¼ miles ; by the north side it is 145½ miles.

Route from Fort Laramie to Fort Pierre.

Distance from Fort Laramie.

Fort Laramie is situated on the north side of Laramie river, 1 mile from the Platte. There are two ways of reaching White river from this fort that have been travelled with

Distance from Fort Laramie.

wagons; one of them, as described to me by Mr. Bordeaux, is to go down the Platte about 8 miles, then north, crossing Raw-hide creek in 8 miles; thence to first fork of Spoon-hill creek, 12 miles; thence to the second fork, four miles; thence to l'Eau qui Court river, 12 miles; travel down l'Eau qui Court, 12 miles: then go north 12 miles to head of Deadman's creek; then along it 6 miles to White river; the last 6 miles are bad; this route then joins the other, and is probably preferable. The army took the other route, which strikes White river near its source. The route is as follows:

September 29, 1855.—Crossed the north fork of the Platte 1 mile from the fort; river about 130 yards wide, water in places 3 feet deep, current strong, bottom hard with small boulders, stream not fordable when high: camped at a spring hole; grass bad, no wood; road good, a little hilly and sandy; day's march 13 miles - - - - 13

September 30.—Marched to Raw-hide creek, $7\frac{1}{4}$ miles; grass here tolerable, with some rushes; small cottonwood along the banks; formerly large groves existed, which have been used up by the Indians; stream 10 feet wide, water plenty, containing fish - - - - - - $20\frac{1}{4}$

October 1.—Marched $23\frac{1}{2}$ miles to l'Eau qui Court river, road good; no intermediate camping place; a little water can be had 4 miles from morning camp. L'Eau qui Court here is from 10 to 15 feet wide; clear running water, containing fish, bottom sandy; grass fine; no wood—formerly there was plenty, but it has been used up by the Indians; stream heads near Raw-hide peak; saw numerous bands of buffalo to-day - - - - - - - $43\frac{3}{4}$

October 2.—Marched $11\frac{3}{4}$ miles to near the head of White river; road good; descent to the stream very steep; stream 4 to 5 feet wide, with large holes, water clear, bottom sandy; grass good; no wood, except small willows; fuel plenty 1 mile further down; bluffs 150 feet high, and close to each other. Exact source of the river not known.

October 3.—Marched 11 miles down White river, crossing it 11 times; immediate banks not high and bottom hard; the road is so bad that it is next to impracticable for loaded wagons; it requires much working, and then would probably not be passable when the stream is flooded. The bluffs are high, precipitous, and close to the stream, and covered with scattering pine; ash, elm, willows and cottonwood line the banks: camp was on the left bank, at the foot of a tall cliff, and here we buried a soldier; the valley begins now to widen out; grass good - - - $66\frac{1}{2}$

October 4.—Crossed the stream, marched $4\frac{1}{4}$ miles and camped on the right bank at the mouth of Deadman's creek; grass good - - - - - - - $70\frac{3}{4}$

Distance from Fort Laramie.

Along White river good grass and wood will be found at almost every point the remainder of the way; the road is generally fine in dry weather, but, being clayey, is very heavy in wet seasons. The high rocky bluffs recede on the south side to a distance of from five to twenty miles, and in the north are only occasionally to be seen. Beaver abound in all the streams, and deer along the banks; the bottom of the stream is generally muddy and care must be used in approaching it. The route continues along the stream till forced away by the high bluffs of the Bad Lands.

October 5.—Crossed White Clay creek with ease, $8\frac{3}{4}$ miles from morning camp; water of a milky color. White river, before clear, now assumes a white tinge; crossed White river $8\frac{1}{2}$ miles further on. Days march $17\frac{1}{4}$ miles; road good, and crossing easy. - - - - - - 88

October 6.—Marched 16 miles; last 8 miles of road very bad, several wagons being overturned, and many things broken about the gearing. - - - - - 104

October 7.—Marched $19\frac{1}{2}$ miles; road good, except a few crossings of side ravines; these might be much improved; there are two or three considerable hills. - - - $123\frac{1}{2}$

October 8.—Marched 16 miles; road good. Sharp-tailed grouse quite numerous. - - - - - - $139\frac{1}{2}$

October 9.—Passed Butte Caché about 2 miles from morning camp; this is so low as to be hidden by the trees; the locality is a favorite resort for the Indians in winter, and the Fur Company have built trading houses here, which are now abandoned. Crossing White river at a good ford half a mile further on, we encamped on the right bank; day's march 14 miles; road good - - - - $153\frac{1}{2}$

October 10.—Passed through a small portion of the Bad Lands; day's march $6\frac{1}{2}$ miles. Camped on the right bank, one mile above Wounded Knee creek, a favorite resort of the Indians. Two miles below this, a very high ridge of the Bad Lands comes down to the river. The road now leaves White river and, proceeding directly through the Bad Lands, gains the side branch of the Shyenne. White river continues its way through the high precipitous bluffs of the Bad Lands, from which it emerges near the south fork, a distance in a straight line of 95 miles. There are no streams of any size running into it on the left bank, but on the south or right bank there are many, from 20 to 40 miles long, with clear running water, and are much resorted to by the Indians. - - - - - 160

October 11.—Crossed White river, here 40 yards wide, at a good ford, and fairly entered the Bad Lands; road fair in dry weather, but crooked; camped at Ash Grove spring, situated on a ridge; grass good; ash wood plenty, and good water. There are very deceptive miry places in the

Distance from Fort Laramie.

neighborhood and the animals require watching; day's march, 18½ miles; no intermediate camp. - - 178½

October 12.—Had to go down a long steep hill, (one mile from morning camp,) sandy and easy to descend, but must make a very hard pull up. Marched to Bear creek, a branch of the Shyenne; banks here high, and hard to get up with loaded wagons; water in holes, but salt; will do for the animals. Spring on the side hill furnishing good water, but quantity limited. Some ash wood around the spring; grass indifferent. Day's march 13½ miles. - - 192

October 13.—Nine miles from morning camp, crossed Sage creek, about one mile above its forks; banks on Sage creek high and hard to pull up; water in holes, tolerable; grass good; wood plenty; marched to Bull creek, 11½ miles on, here grass good, wood sufficient, water in holes, good; day's travel 20½ miles, road being over high prairie. - 212½

October 14.—Marched to Pinos spring, one of the head branches of Bad river; descent to the valley of the stream quite steep; valley here three to five miles broad; water in a hole, a little salt; wood one mile off; grass indifferent; day's march, over good road, 17¾ miles. - - - 230¼

October 15.—Marched to Grindstone Buttes creek (*Buttes aux Gres creek*) 18¼ miles; road good; passed several good camping places; at camp, grass and water good; wood scarce. - - - - - - 248½

October 16.—Passed some wood after going 4¾ miles, and Big Cottonwood creek 4¼ miles further on; here no wood; camped at Mitchell's creek; water good, in holes; no wood; grass good. Day's march 14 miles; road good. - - 262½

October 17.—Passed Aricaree creek, in 7 miles; here no wood, but some trees visible half a mile down; camped on La Chapaille creek; a little wood; water in holes, bad; grass good; day's march 21¼ miles, road good. - - 283¾

October 18.—Passed tolerable camping place in six miles; marched to Water Holes creek; water good; grass fair; no wood; trees about one mile down stream; day's march 14¼ miles; road good. - - - - - 298

October 19.—Good road to crossing of Willow creek, 17 miles, the banks of which are high, and give a long hard pull; wood here plenty, but no water. There is a small hole, always filled with water, about half a mile east of the creek, slightly salt; camped at Fort Pierre; day's march 25 miles; bluffs of the Missouri not steep where the road descends. - - - - - - - 323

Route from Fort Pierre to Sioux City.

Distance from Fort Pierre.

The ferrying across the Missouri, on account of the low water, had to be done at a point about six miles above the fort, and the distances are from this place.

October 27.—Took the road over high level prairie to the mouth of Medicine creek, 22 miles. Here good grass, water and wood; stream 20 yards wide - - - - - 22

October 28.—First two miles along the foot of the Missouri bluffs, and very rough; remainder over level prairie to La Chapelle creek near its mouth; here wood, water, and grass good; stream 10 yards wide; day's march 9 miles - 31

October 29.—Route took to the high prairie; reached Chaine de Roche creek in $15\frac{3}{4}$ miles; no wood nor water; $5\frac{1}{4}$ miles further, we head a ravine with a little water, and no wood; thence to Campbell's creek, $16\frac{1}{2}$ miles; here plenty of wood, water and grass; road all the way good; day's march $37\frac{1}{2}$ miles - - - - - - - $68\frac{1}{2}$

October 30.—Marched 5 miles; crossed Shompepi creek, with plenty of wood, running water and grass; 5 miles further camped on Elm creek; plenty of wood, running water and grass - - - - - - - $78\frac{1}{2}$

November 1.—Marched over good road, $17\frac{3}{4}$ miles, to Crow creek; here good grass and water, but no wood - - $96\frac{1}{4}$

November 2.—After going six miles, imperceptibly reached a high ridge, with lakes; thence to Fire Steel creek, (*Chanka W.*,) $6\frac{1}{2}$ miles; proceeded along this stream for 11 miles, crossed it, and camped; here grass and water, but very little wood; day's march $23\frac{1}{2}$ miles, over good road - $119\frac{3}{4}$

November 3.—Proceeded along southside of Fire Steel creek to camp; day's march, $19\frac{3}{4}$ miles; wood, water and grass good; camp 4 to 5 miles from James river. We were now on burnt prairie, which continued the rest of the journey, and grass could only be found in patches, in protected places - - - - - - - $139\frac{1}{2}$

November 4.—Crossed *Toka Kiya W.* or Enemy's creek, in 10 miles; here are wood, water and grass; stratified rocks are along its banks below the crossing: thence to *Riv. à Jaques* or James river, or *Chan San W.*, (White Wood river,) $8\frac{1}{2}$ miles; thence to camp on James river, $4\frac{1}{2}$ miles; day's march, $23\frac{1}{4}$ miles - - - - - - $162\frac{3}{4}$

The crossing of James river is at a boulder rapid, and is good; there is no other ford; the banks are miry, and care must be taken in approaching. When flooded, its valley is submerged for a mile in width, and cannot be forded. The stream is about 25 yards wide, with full banks—it is 70 or 80 yards wide; wood enough for fuel exists along the stream.

November 5.—Proceeded along James river $3\frac{3}{4}$ miles; thence to Black Earth creek, *Maka Sapa Ouza*, (the place where

Distance from Fort Pierre.

they get black earth,) 12¾ miles; here are oak wood, water and grass; road good; day's march, 16 miles - - 179¼

November 6.—To head of Turkey Ridge creek, 12½ miles; kept on the north side for 4 miles; water, but no wood, and grass burnt off; crossed the stream and proceeded one mile; camping in the Turkey Ridge, *Zhicha Kaga;* oak wood here, and water in springs; grass nearly all burnt off; day's march, 17½ miles - - - - - 196¾

November 7.—Proceeded over the high prairie, studded with little lakes, and left the Coteau du Missouri about 9 miles before reaching the Vermilion; day's march, 27½ miles - 224¼

The road, since leaving Fort Pierre, has been over gravel and boulders of the drift formation, covered with soil only one or two inches thick, and consequently hard and good for roads at all times. From here to the settlements the soil is thick and dark, as in Iowa, and probably as fertile; it will make very heavy roads in wet weather. The Vermilion river, *Washesha Ouza W.*, is about 25 yards wide, not easily crossed on account of the mud; there is, however, no other ford, except at its head; there is plenty of oak wood here for fuel, and fine grass.

November 8.—Road to-day good, over fine fertile prairie to Lungs creek; here wood, water and grass; day's march, 16½ miles - - - - - - 240½

November 9.—Struck the Big Sioux after going 11¼ miles; thence to the Big Sioux ferry, 15¼ miles; from the ferry to Sioux city is 7 miles - - - - - 267 274

As this route has very little wood, it is not safe in very cold weather, and as at such times we may calculate on crossing the Vermilion and James rivers, near their mouths, on the ice, the route near the Missouri river should be taken. The following distances, &c., along it were given me by Mr. Henry Goulet: From the Big Sioux ferry go direct to near the mouth of the Vermilion, where the point of the bluffs end; 14 miles from the Big Sioux is a lake, with large willows for fuel; 4 miles further, plenty of wood at a spring; thence to Vermilion, 16 miles; take now the ridge of the high prairie straight to where James river comes out from the bluffs, in 16 miles you reach White Clay creek; water in a spring, and wood plenty; thence to James river, 17 miles; from this river to the forks of Manuel creek is 25 miles, and here you are 12 miles from the Missouri, not far from l'Eau qui Court river; at the forks plenty of wood. The next camp would be on Andy's lake, 27 miles; here wood is plenty; from this lake to *Yagalinyaka creek*, 14 miles, wood plenty; thence to Pratt's creek, 20 miles; thence to Bijou hills, 17 miles; thence to Crow creek, 25 miles. If this route should be taken in the spring and summer, the Vermilion and James rivers must be crossed by a ferry.

Distances from St. Louis to the mouth of Yellowstone river.

	Miles.		Miles.
From St. Louis—		From St. Louis—	
To mouth of Missouri river	20	To James river	1113
To St. Charles	45	To Sleigil's Fort, or Dare Hills	1143
To mouth of Gasconade river	129	To head of Bonhomme island	1158
To mouth of Osage river	164	To l'Eau qui Court river	1193
To mouth of Grand river	300	To Grand Tower	1233
To Lexington City	370	To Cedar island	1283
To Kansas river	456	To Bijou Hills	1313
To Fort Leavenworth	498	To White Earth river	1333
To Fort Weston	505	To Old Fort aux Cedres (Second Cedar island)	1347
To Fort St. Joseph	590	To Fort Lookout	1365
To Fort Bellevue	646	To Fort of Great Bend	1383
To Omaha and Kanesville	742	To Medicine creek	1413
To Old Council Bluffs	807	To Third Cedar island	1430
To Little Sioux river	882	To Old Fort George	1454
To Cook's Wood Yard	897	To Fort Pierre	1478
To Wood's Bluff	912	To Big Shyenne	1538
To Blackbird Hills	927	To mouth of Moreau river	1634
To Chalk Bank	942	Cannon Ball river	1764
To Omaha creek	958	To Heart river	1814
To Omaha City	964	To Fort Clark, or the Aricaree village	1879
To Sargent's Bluffs	978	To Fort Berthold, or the Gros Ventres village	1944
To Big Sioux river	983	To Fort of Big Bend	1984
To Iowa Bluffs	1028	To White Earth river	2034
To Fort Vermilion	1043	To mouth of the Yellowstone	2184
To Vermilion river	1063		
To Petit Arc river	1088		

APPENDIX B.

Survey of Military Reserve at Fort Pierre.

FORT PIERRE, *August* 7, 1855.

MAJOR: Having completed the duties assigned me at this post, by your instructions of June 4, I shall set out to morrow to return to Fort Leavenworth *via* Fort Kearny. My party consists of six experienced men of the country, mostly half-breed Sioux, and Mr. Carrey and myself. We are well supplied with every thing needful, and expect to be at Fort Kearny in from fifteen to twenty days. We shall travel as men of the country, and exercise the greatest vigilance.

The Brulés, we are told by an Indian who arrived to-day, are in the Sand Hills, and are no worse to emigrants and traders than they were before the Grattan massacre. They are excited, however, against the soldiers, and would probably not lose an opportunity to destroy a small party, if it should be afforded them. These are the only Sioux we have any apprehension of.

There is a band of Ihanktonwans on the left bank of the Missouri, some forty or fifty miles above l'Eau qui Court, said to be desirous of making peace. The Ihanktonwannas are scattered along the left bank above Fort Pierre. The Unkpapas, Minikanyes, Sans Arc, and Blackfeet Sioux are dispersed along the north fork of the Shyenne and Powder rivers, and on the head of the Upper Little Missouri.

I send herewith a sketch of a survey from Chantier river to Antelope river, a distance of thirty miles, made for the purpose of determining a suitable military reserve; and one also of a reconnaissance made from Chantier river to the Shyenne, a distance by the road we took, (a lodge trail,) of forty miles.

The limit of the reserve, as established by order of Colonel Montgomery, can be seen on the sketch. It embraces 310½ square miles, about fourteen only of which are of any value. This great extent is required on account of the limited resources which the country seems to possess; these, however, are not yet fully known, and future experience may enable the War Department to reduce the reserve to much smaller dimensions. This year, the country is presented to us in its most unfavorable aspect, because of the deficiency of the spring rains; and many places that generally furnish an abundance of hay, now have none.

Of the probability of success in cultivating the low prairies like the one on which the fort is situated, I am not prepared to speak; they seem to be composed of the washings from the black clayey bluffs, and not a deposit from the river. At the site of the fort the grass has been killed by the Indian lodges, and all the cottonwood destroyed in giving the bark to their horses in winter; there is also a great deal of wild sage growing on this plain. It, in fact, seems to be the most barren of the low prairies I have visited. The landing here is very changing; this season it is better than usual, but any high water may put a dry sand bar in front of the fort half a mile wide; at present the steamboats discharge their freight nearly a mile from the depot. However, within the limits of the reserve, there is no place for a fort on the right bank of the river superior to the one now occupied. As far as I have examined the river, the best places are on the left bank.

The islands that do not generally overflow (there are none wholly exempt from floods) are good for cultivation. The one included in the reserve is about two miles long by a half a mile wide, and contains a considerable prairie yielding good grass for hay; it has also a good supply of timber, (cottonwood;) it is eight miles below the fort. The other valuable parts of the reserve are, the point on the left bank near the island just mentioned; a portion of the valley of the Little Missouri; and the point on the left bank, about ten miles above the fort. These combined are thought by those most competent to judge to be ample for furnishing the necessary quantity of wood, grass, and arable land. The ravines in the bluffs are excellent places for the cattle in winter, as they furnish shelter and food, and the earliest grass in spring. I have not completed my examination of the Little Missouri, and it is for that reason, I have left it out on the sketch.

In making the reconnaissance to the mouth of the Shyenne, I was obliged to go by land, or wait indefinitely for the boat; I chose the former alternative, and visited all that was necessary to satisfy myself. I had the same party that goes with me to Fort Kearny, and they knew the country well. About four miles above Chantier river is Galpin's camp, with the party that vacated Fort Pierre on the arrival of the troops. This is a good site, has a considerable quantity of grass

and wood, but not much timber fit for building; the landing is not good, better, however, than that of Fort Pierre, and it is in general a more eligible locality.

The next place worth speaking of is De Bouis' point. This is a strip of bottom land about five miles long, and from a quarter to three quarters of a mile wide; it has an abundance of the finest grass and timber, and a permanently good landing. This place and Crook's point, nearly opposite, would furnish all the supplies needed; there seems, however, no place to locate a fort which would not be too far from the river without subjecting it to being slightly flooded during extraordinary freshets; the bottom is also so flat as to probably remain wet long after a rain. The next desirable location is on what is called "The point below the Shyenne;" this is a prairie from fifty to a hundred feet above the river, about five or six miles long, north and south, and a mile and a quarter wide; at the upper side there is a fine permanent landing, and there is said to be one at the lower side. There is a fine belt of wood at the lower end, and just at the upper end is a large island probably equal in every respect to the one included in the reserve. Altogether this point is a desirable one, and apparently offers, right at hand, nearly all the resources of this country. It is, by water, forty-five or fifty miles above Fort Pierre. Formerly an Aricaree village existed here of more than three hundred lodges. I have been informed that the American Fur Company intend building upon it, but this is, as yet, doubtful. The general opinion is that the trade with the Sioux in this vicinity is ruined forever, and that it will not be profitable to incur the expense of establishing a trading post. The immediate vicinity of the mouth of the Shyenne is not good for establishing a military post; the north side is the best, and is good for trading. Dupuis is camped there with the party formerly at Fort George. I believe they intend to build houses, and occupying it permanently. Above the Shyenne, there are said to be many good points for wood.

The Shyenne is at present about one hundred and twenty feet wide, and eighteen inches deep at the mouth. There is said to be good cottonwood in limited quantities as far up as Cherry river, (60 miles;) above that it has mainly been destroyed by the Indians, to get the bark. There is no pine on it until it enters the Black Hills; some ceder is found along the bluffs. The river is subject to very sudden rises, and falls equally fast; it is very crooked; and when high, has a very swift current; Mackinac boats have been brought down in time of high water, but it does not promise much in the way of steam navigation. I have said nothing about the roads to and from the different places spoken of. In this respect they are all about equal. With some labor on the first mile and a half of the bluffs, the road in dry weather would become good for loaded wagons, in almost any direction. Every point from Fort Pierre to the Shyenne would connect well with the Laramie or Moreau roads, or with the route to the Black Hills, between the forks of the Shyenne.

The Moreau road crosses the Shyenne fifteen miles from its mouth: there is another crossing three miles from its mouth.

The sketches must be excused for want of neatness, as they were made with the least possible facilities.

In what I have so far accomplished, I have been essentially aided by Mr. Paul Carrey.

Whatever may be the comparative defects in the site of Fort Pierre for a military post, it is evident that it is the only one in this part of the country that could be occupied this year as a depot, and the labor that will have been expended before another season comes around may render the removal of the post an affair of doubtful expediency.

I am, sir, your obedient servant,

G. K. WARREN,
Lieutenant Topographical Engineers.

Major O. F. WINSHIP,
Assistant Adjutant General,
Of Sioux Expedition.

APPENDIX C.

Report of September 4, 1855, *and sketch of Battle Ground at Blue Water Creek.*

BLUE WATER CREEK, *September* 4, 1855.

MAJOR: I present herewith a sketch of the Blue Water creek, (in the Sioux language, "Mini-To-Wa-pa-la,") comprising the field of operation of the 3d instant. I have appended such notes as will, I hope, make it intelligible. The distances are all estimated and corrected by magnetic bearings. All parts of the scene are included except about the last six miles of the pursuit by the mounted force.

Blue Water is about twenty feet wide and two to three feet deep, flowing over a rocky or sandy bottom; the immediate banks are generally abrupt and three to four feet high, requiring care when approached on horseback. It will be seen the stream is tortuous, and about every mile strikes against steep bluffs as it winds from side to side through its valley. This valley is about half a mile wide, and contains several very miry sloughs. These things combined formed a serious obstacle to the pursuit.

I aided in bringing in the wounded women and children who were found near the place to which the Indians first fled. These had secreted themselves in holes in the rocks, in which armed savages also took shelter, and by firing on our men compelled them, in self-defence, to fire back, which caused the destruction of the women and children, whom the soldiers were unable to distinguish in the confusion and smoke. Near one of these holes two soldiers, five Indian men, seven women, and three children were killed and several wounded. Colin Campbell, the guide and interpreter, who accompanied me from Fort Pierre to Fort Kearny, rendered essential service in taking care of the wounded, beside acting as interpreter at the "talk." From him I obtained the numbers for the lodges (41 Brulés,

11 Ogalalas) given on the sketch. He says the number of prisoners taken is about seventy, of whom four are Ogalalas, of the family of Chan-ta-pe-tan-ya, being his squaw and three children. The Brulé chief, Little Thunder, was not killed. Campbell gained his information from the prisoners. None of them know the length of the Blue Water creek, but suppose it to be about fifteen miles, and to have its source in a lake of the Sand Hills.

I am, very respectfully, your obedient servant,

G. K. WARREN,
Lieutenant Topographical Engineers.

Major O. F. WINSHIP,
Assistant Adjutant General,
Headquarters Sioux Expedition.

NOTE.—The Indians were killed in places far apart, and in situations where the dead bodies could not easily be seen, so that it was almost impossible to make a correct estimate of the slain from observation after the fight. I passed very close to one body several times without discovering it till the fourth day after, when my attention was only attracted to it by a group of ravens.

APPENDIX D.

Meteorology.

The notes on the weather while travelling, from June 15 to November 16, 1855, are given by themselves. The thunder storms appeared to me entirely similar to those I have witnessed in the valley of the upper Mississippi and at West Point: they invariably came from the west, sometimes passing over and returning. Where they sweep over the unbroken prairie, the wind has great violence.

As a general thing, south winds were always followed by thunder showers from the west; sometimes this south wind, falling during the night and beginning in the morning, lasted three and four days before a thunder storm came. I was told by one of the traders of the American Fur Company, that some twelve years ago there was a snow storm in the month of May, when the trees were in leaf, that caused a fall of three feet of snow at *Chaine de Roche* creek, near the Great Bend. It lasted a day and night, and was accompanied by appalling thunder; a great many buffalo perished, and the Indians lost numbers of their horses.

Snow storms, in the region of Fort Pierre, are very uncertain, and come up very suddenly. Several persons have perished from these not far from the fort. Some winters, as that of 1854, 1855, there was no snow. In the spring of 1855 no rain fell, and this dry spell continued till about the 1st of August. Our pyschrometrical observations embrace the close of this period, as rain and snow fell plentifully the remainder of the season.

The climate is evidently not well adapted to agricultural pursuits; and the occasional severity of the winters would cause great suffering and loss to the flocks and herds of a pastoral population.

The observations at Fort Pierre were made mainly by Mr. J. Hudson Snowden, being relieved from 12 o'clock at night till 6 in the morning by Mr. Paul Carrey and myself. Our short stay, and numerous other and fatiguing duties during this sultry season, prevented the observations being extended over a longer period.

The psychrometer was made by James Green, of New York, and is the same as that adopted by the Smithsonian Institution. The observations made with it at Fort Pierre are in every way reliable, as the circumstances were favorable to securing the proper air temperature, the air having free circulation, and there being no sun's rays or reflecting bodies to influence the instruments; the wet bulb was kept constantly moist, by being encased with a thin linen rag dipping into a vial of water, and care was taken to keep the moisture in the proper quantity over the bulb.

The barometers used were James Green's syphons, Nos. 1013 and 1014. At the time of comparison his standard read 30.107, and the height of the barometric column given by syphon No. 1013 was 30.106, and by syphon No. 1014 was 30.116. These instruments remained in perfect condition till they were accidentally broken—No. 1013 near Fort Pierre, and No. 1014 near Fort Laramie.

Table I gives the observations, altitudes, and distances on the route from Fort Pierre to Fort Kearny; and *table II* from Fort Kearny to Fort Laramie. In *table III* the temperature of evaporation is given, as observed with the wet bulb thermometer, and the difference of this and the dry bulb thermometer similarly exposed, both Fahrenheit. From the readings of the wet bulb thermometer and these differences the elastic force of atmospheric aqueous vapor is deduced, and the per centage of the saturation existing at the time, both by aid of Regnault's tables. The elastic force of vapor, being the share of the barometric height made up by the vapor of the atmosphere, ranges here from .15 to .80 of an inch. In tables *IV and V*, the mean of this elastic force, for the several hours of successive days, is obtained. The last of these shows a small curve of force through the day, attaining its maximum at 2 p. m., and falling to its minimum at the colder hours.

The relative humidity, or per centage of saturation, is low, several times falling below thirty per cent., and only once or twice rising to saturation.

The *hourly barometric observations* at Fort Pierre, reduced to the freezing point, and expressed in inches, are arranged in *Tables VI and VII* to give the mean at similar hours for the days so observed.

Each barometer gives an approximate curve of the changes in the successive hours of the day and night in this way; but they are not fully observed, and the irregular variations are so great that the differences are not regular as derived from so short a period. The mean of the entire number of corrected observations made hourly is quite the same for each barometer, however, and the summary for the representation hours 7, 2, and 9, *Table VIII*, for twenty-three days, differs but little; this last is used in calculating the altitude.

From the hourly observations of the best barometer (No. 1014) corrections, *Table IX*, for each hour are derived, (interpolating for "lost" observations when the curve is not regular.) The measures

of corrections are large, but they are clearly within the determined range shown to exist at Fort Pierre by these observations.

These corrections are applied in all the computations of altitude, as well as correction for the non-periodic variation obtained by comparison with the barometric observations made by the United States medical department at Forts Snelling, Kearny, and Leavenworth.

It will be seen that I place the altitude (1,504) of Fort Pierre nearly the same as that given by Nicollet, Fort Kearny (360 feet) below that given by Captain Stansbury, and Fort Laramie (269) below that given by him. After careful examination of my own observations, I am constrained thus to differ.

Mr. J. Hudson Snowden made nearly all the calculations, and deduced the results given in the tables, and Mr. Lorin Blodget assisted me in the preparation and arrangement of this portion of the work.

NOTES ON THE WEATHER.

Saturday, June 15.—Left Fort Leavenworth; wind to-day south, 5.

June 16.—Wind south, 7; cumulus clouds thick in the north at sunset.

June 17.---Overcast; raining a little occasionally in the morning; wind light; clear and hot in the afternoon; in the evening cumulus clouds occupied the horizon from north around by west to south, and at 9 o'clock there were continual flashes of lightning; about 12 o'clock a most terrific storm of wind, rain, lightning, and thunder came upon us from the west, and lasted for an hour.

June 18.—Clear most of the day and warm; at dark another threatening storm appeared in the west, but did not reach us.

June 19.—Very warm.

June 20.—Very warm; at sunset another violent thunder shower came from the NW.; rained during the night.

June 21.—Clear and cool; wind light NW.; was able to see the North Star for the first time since the 15th.

June 22.—Clear and cool; thermometer at noon 74°; at midnight 61°.

June 23 and 24.—Fair.

June 25.—Near the mouth of the Vermilion river; wind SW., 7, during the day; thermometer at noon 87½°, wet bulb 72½; at sunset dark cumulus clouds came from the north, wind at the time blowing a gale from the south; at 9 p. m. barometer 28; attached thermometer 81°, detached 74°; raining heavy to the north, and a storm passing south of us moving to the SE., wind now NW., 7 or 8. The flashes of lightning from these clouds to the north and south, running up to the zenith in diverging lines, had a startling effect, and one could not look upon them without shrinking. There was but little thunder; the lightning was in vivid white streaks, sometimes rose and violet colored. Where we were but little rain fell, and we had a distinct view of this commotion of the elements around us.

June 26.—Clear and nearly calm.

June 27.—High south wind all day, and a violent storm again from the NW. in the night.

June 28.—Cloudy, rainy, and nearly calm most of the day.

June 29 and 30, and *July* 1, 2, 3, 4, 5, 6, and 7.—Weather cool, sometimes clouded, but no material rain; most of the time north wind.

July 9, 10, and 11.—Wind fresh from the south.

July 12.—Strong NE. wind, and light thunder showers from NW.

July 13.—At the Great Bend violent northwest wind storm, which blew the water out of the river in spray; but little rain or thunder.

July 14.—Wind strong south. (?)

July 15.—Wind light; at 2 p. m., thermometer in the shade 102°; in the sun 107°; wet bulb 69°, wind slight northwest; shower towards night, but the rain all evaporated again before reaching the earth.

July 16.—Clear and very warm.

The above observations were made on the steamboat. The observations on the weather from July 16, to August 9, will be found in the table with the observations of wet and dry bulb thermometers at Fort Pierre.

The following notes on the weather accompany the meteorological observations from Fort Pierre to Fort Kearny.

August 9, 6 *a. m.*—Clouds 3; 1½ p. m., cumulus 3; wind northwest 3; several thunder showers crossed the prairie in the afternoon, moving to the southeast; much thunder and rain during the night.

August 10, 6½ *a. m.*—Rain; clouds 9; calm, thermometer 66½°; wet bulb thermometer 64°; in the forenoon sun shone at intervals; 12 m. heavy thunder shower to the east, wind at the time northwest 6; at sunset calm; 9 p. m. clouds, raining slightly; wind northwest 5.

August 11.—During the day clouds varying from 7, 3 to 8; wind northwest; from 3 to 4, some slight sprinkling of rain; 5 p. m., thermometer 61°; wet bulb 52°.

August 12, 6¼ a. m., thermometer 56°; wet bulb 54°; clouds all day 7 to 8; wind northeast; 2 to 3, sprinkling of rain.

August 13.—Until 10 a. m., surrounded with fog and mist; wind southeast, 3; occasional sprinkling of rain; 11½ a. m., clouds, 10; no fog; 2½ p. m., clouds, 9; wind southeast, 3; upper clouds, wind northwest; 7 p. m., wind north, 5; high prairie covered with fog and mist.

August 15.—Clouds, 3 to 5; wind northwest, 3; 6½ p. m., clear and calm.

August 15, 7½ to 10 a. m., wind northwest, 5; clouds, 10; misty rain; temperature of Rapid river 70°; at midday, sun shone; 7 p. m., nimbus clouds, 8; rainy, wind northwest, 4; temperature 11½ p. m., 51°.

August 16, 5½ a. m., clouds; 9½, low and flying, wind northeast, 5; 7 p. m., clouds, 1; in horizon calm; continued so nearly all night.

August 17, 5½ a. m., clouds, 9; clear around the sun, wind northwest 2; cleared up as the day advanced; 6½ p. m., clouds, 2; upper wind west, lower wind east, 4.

August 18, 5½ a. m., clear, wind east, 4; wind soon changed to the south, 6; 7 p. m., clear; wind south, 6.

August 19, 4½ a. m., clouds, 5; cirrus, wind south, 4; all day it was south, 6; 7 p. m., nearly calm.

August 20, 5½ a. m., clouds, 4; thunder during the morning; rained a little during the day; 7 p. m., clouds, 9½ nimbus; wind north, 5.

August 21, 5¼ a. m., clouds, 9; wind northeast, 1; 7 p. m., clear, wind northeast, 1.

August 22, 5½ a. m., clear and calm.

Observations from Fort Kearny to Fort Laramie.

August 25, 6 a. m., foggy; wind southeast; day clear and warm.

August 26, 27 *and* 28.—Cloudy in the morning; clear and warm at noon, and in the evening.

August 29, 5½ a. m., clouds, 10; wind east, 1; day clear and warm.

August 30, 4½ a. m., clouds, 1; wind east, 6; 3 p. m., clouds, 2; wind southwest, 5.

August 31, 6 a. m., calm; clouds, 1, in the horizon to the north; no dew; clouds soon moved south with northeast wind, 5, and covered the whole sky; 4½ p. m., wind north, 4; clouds, 5; thermometer 81; wet bulb 71°; temperature of the Platte 73°; in the night there was a violent thunder storm, and a heavy fall of rain; a horse was killed by the lightning.

September 1, 5½ a. m., calm; clouds, 8; 3¼ p. m., clouds, 2; cumulus in the horizon; cirrus overhead; wind southeast, 1.

September 2, 6½ a. m., all mist and wind, northeast, 1; 6 p. m., cumulus, clouds, 2; wind southeast, 2.

September 3.—Cumulus; clouds filled the sky nearly all day, and showers were in several parts of the horizon with thunder; 9 p. m., commenced raining hard.

September 4 *and* 5—Warm.—*September* 6, heavy rain at 5 p. m.

September 7, 8 *and* 9.—Warm and fair.

September 10, 5½ a. m.—Cirrus; clouds, 5; calm; 2 p. m., clouds, 10; cumulus and nimbus; wind northwest, 6.

September 11, 6 a. m., clouds, 10; wind northeast, 7.

September 12, 5¾ a. m., clouds, 10; wind northeast, 1.

Observations from Fort Kearny to Fort Laramie.

September 13, 5½ a. m.—Clouds, 1; cirrus, calm, heavy dew; day clear and hot.

September 14, 6 a m.—Clouds, 2 in horizon; calm.

September 15, 6 a. m.—Clouds, 3 cirro stratus; calm; day very warm.

September 16.—Dense fog in the morning.

September 19, 8 a. m.—Clouds, 10,; wind southeast, 6; raining a little, and did so all night.

September 22, 5 p. m.—Thermometer 66°; clouds, 9½; wind west, 5.

Observations from Fort Laramie to Fort Pierre.

September 29.—Fair day; little rain after dark, with high north wind, 7.

September 30, 6 a. m.—Thermometer 44; no dew, wind northwest, 7

October 1.—Sunrise, thermometer 43°; day clouded.

October 2.—Thermometer at sunrise 32°.

October 3.—The day was quite warm, 4 inches snow fell in the night at the head of White river.

October 4.—Thermometer at sunrise, 29°; snow melted during the day, the ground being quite warm.

October 5.—Thermometer at sunrise, 23°; wind northwest 5, during the day.

October 6.—Sunrise, thermometer 29°; day fine.

October 7, 8, and 9.—Weather fine.

October 10.—Thermometer at sunrise, 54°.

October 11.—Thermometer at sunrise, 28°.

October 12, 13, and 14.—Fine cool weather.

October 15.—Thermometer at sunrise, 36°; cool all day.

October 16.—Fair.

October 17.—Very warm.

October 18.—High north wind all day.

October 19.—Very fine day.

October 20.—At Fort Pierre; commenced raining at daybreak; changed to driving sleet and snow, with strong northeast wind; men and animals suffered severely.

October 21.—Storm of sleet continued, with occasional pauses; the wind changed to nearly every point of the compass; everything covered with ice.

October 22.—Weather somewhat clear; thermometer about 23°.

October 24.—Clear, wind south, 6.

October 25.—Clear and cold, wind northwest, 6.

October 26.—Wind northwest, 4.

Observations from Fort Pierre to Sioux City.

October 27.—Thermometer at sunrise 30°; day clear; wind north, 4.

October 28.—Thermometer at sunrise 42°.

October 29.—Thermometer at sunrise 31°; wind south, very high a short time in the morning.

October 30.—Sunrise, thermometer 26°.

October 31.—Sunrise, thermometer 26°.

November 1 and 2.—Fair days.

November 3.—Thermometer at sunrise 19°; day fine.

November 4.—Thermometer at sunrise 39°; misty; clouds covered the sky and betokened a storm; rained in the afternoon and night.

November 5.—At Turkey creek; thermometer at sunrise 43°; morning cloudy, clouds rising in the east; heavy fog banks in the northwest; strong northwest wind succeeded at 8 a m., enveloping us in fog, and finally in a bitter driving storm of sleet and snow, which it was almost impossible to face; continued till 8 p. m.

November 6.—Thermometer at sunrise 29°; day clear.

November 7.—Thermometer at sunrise 28°; day clear.

November 8.—Thermometer at sunrise 29°; day clear.

November 9 and 10.—Fine.

Observations from Sioux City to Kanesville.

November 11.—Snowed and rained all the afternoon.

November 12.—High northwest wind, with snow squalls.

November 13.—Fine day.

November 14.—Cloudy; commenced raining about dark, and rained all night.

November 15.—Misty rain all day.

November 16.—Cool and cloudy; snow fell in the night about 5 inches in Kanesville, Iowa.

TABLE I.

Route from Fort Pierre to Fort Kearny.—Altitudes and distances.

Station.	Date.	Time.	Place of observation.	Height of barometer 32° Fah.	Mean.	Air, temperature.	Altitude in feet.	Intermediate distance.	Distance from Ft. Pierre.
1	Aug. 8	9½ p. m.	Bad river (Little Missouri river).	28.447	.....	62.	.....	.....	.....
1	9	6 a. m.	.....do.....do.	28.420	28.433	53.57	1477.5	4½	.....
2	9	1½ p. m.	At a small water hole.....	27.656	27.660	92.	2325.0	22.75	27.25
3	9	9¼ p. m.	Medicine creek.....	27.769	.....	67.	.....	.....	.....
3	10	6½ a. m.	.....do.	27.685	27.703	66¼.67	2220.	6	33.25
4	10	9 p. m.	White river.....	28.052	.....	69.	.....	.....	.....
4	11	5½ a. m.	.....do	28.148	.....	46.	.....	.....	.....
4	11	1½ p. m.	.....do	28.251	.....	76.	.....	.....	.....
4	11	5 p. m.	.....do	28.276	.....	61.	.....	.....	.....
4	11	6½ p. m.	.....do	28.316	.....	59.	.....	.....	.....
4	11	8 p. m.	.....do	28.439	.....	53.	.....	.....	.....
4	12	5½ a. m.	.....do	28.426	.....	59.	.....	.....	.....
4	12	6¼ a. m.	.....do	28.440	.....	56.	.....	.....	.....
4	12	6.40 a. m.	.....do	28.452	28.332	56.59	1580.	19	52.25
5	12	7 a. m.	Bluffs of White river.....	28.247	28.226	58½.58½	1680.	.....	.....
6	12	9¼ a. m.	On a hill, average of high prairie.	28.008	27.969	56.56	1944.	7	59.25
7	12	2 p. m.	On a high prairie.....	28.106	28.129	70.70	1900.	9	68.25
8	12	8 p m.	Two-tail creek	28.128	.....	61.	.....	.....	.....
8	13	5¾ a. m.	.....do	28.101	28.245	61.61	1760.	4	72.25
9	13	8½ a. m.	On a high prairie.....	27.895	27.865	63½.63½	2100.	12	84.25
10	13	11½ a. m.	On Dog's Ears creek.....	27.732	.....	71.	.....	.....	.....
10	13	12¼ p. m.	.....do	27.709	27.701	73.72	2230.	2½	86.75
11	13	2½ p. m.	On sand ridge (divide).....	27.555	27.585	80.80	2370.	8	94.75
12	13	7 p. m.	Turtle Hill river.....	27.890	.....	68.	.....	.....	.....
12	14	6 a. m.	.....do.	27.895	27.905	65.66½	1995.	6	100.75
13	14	6¼ p. m.	Rapid river.....	27.852	.....	78½	.....	.....	.....
13	15	7½ a. m.	.....do.	27.875	27.818	69.74	2115.	24¼	125.25
14	15	8½ a. m.	Bluffs on Rapid river	27.706	27.672	70.70	2255.	.....	.....
15	15	7 p. m.	Camp on high prairie.....	27.439	.....	65½	.....	.....	.....
15	16	5½ a. m.	.....do	27.667	27.567	51.58	2330.	7	132.25
16	16	7 p. m.	Sand hills (Les Buttes de Sable).	27.488	.....	56.	.....	.....	.....
16	17	5½ a. m.	.....do .....do.....	27.599	27.558	51.54	2330.	27½	159.75
17	17	6½ p. m.	..... do	27.706	.....	64.	.....	.....	.....
17	18	5½ a. m.	.....do	27.660	27.699	58.61	2355.	23	182.75
18	18	7 p. m.	Water hole on high prairie.....	27.473	.....	72.	.....	.....	.....
18	19	4¼ a. m.	.....do .....do.....	27.407	27.455	59.65	2570.	25	207.75
19	19	7 p. m.	Muddy creek.....	27.587	.....	77.	.....	.....	.....
19	20	5½ a. m.	.....do	27.508	27.537	66.71	2392.9	26¼	235.00
20	20	7 p. m.	Camp on prairie slough.....	27.825	.....	61½	.....	.....	.....
20	21	5¼ a. m.	..... do .....do.....	27.936	27.896	47½.54	2080.	19	253.00
21	21	7 p. m.	Camp on small creek	27.913	.....	61.	.....	.....	.....
21	22	5½ a. m.	.....do	27.777	27.859	44¾.53	2050.	17	270.00
			Platte river.....	.....	.....	.....	2075.	20	290.00
			Fort Kearny.....	.....	.....	.....	2000.	11	301.00

TABLE II.

Fort Kearny to Fort Laramie.

Station.	Date.	Time.	Place of observation.	Height of barometer 32° Fah.	Mean.	Air, temperature.	Altitude in feet.	Intermediate distance.	Distance from Ft. Kearny.
1	.....	.....	**Fort Kearny, on Platte river**.....	.....	.....	.....	2000.	.....	.....
2	Aug. 25	6 a. m.	**Platte river**	27.929	27.824	57½	2075.	11	.....
3	27	5½ a. m.	.....do.....	27.668	27.666	66.66	2335.	36½	47½
4	28	5½ a. m.	.....do.....	27.421	27.419	65.65	2500.1	17½	.....
5	28	7½ p. m.	.....do.....	27.073	.....	85½	.....	.....	.....
5	29	5½ a. m.	.....do.....	27.180	27.138	62.74	2750.	28¼	88¼
6	30	4½ a. m.	South fork of Platte river.....	27.047	27.047	67.67	2887.	18¾	107
7	30	7 p. m.	....do.....do.	26.739	.....	83.	.....	.....	.....
7	31	6 a. m.	.....do..... .....do.	26.784	26.814	64½.74	3100.	21	128
8	31	4½ p. m	.....do.....do.	26.830	26.884	81.81	.....	.....	.....
8	Sept. 1	5 a. m.	.....do.....do.	26.851	26.851	60¼.60¼	3080.	15½	143½
9	1	8¼ p. m.	.....do.....do.	26.667	26.755	90½	.....	.....	.....
9	2	5½ a. m.	.....do.....do.	26.782	26.780	66¼	3210.	21¼	164¾
10	2	6 p. m.	**North fork Platte river (Ash Hollow)**	26.711	26.749	83½.83½	3325.	24½	189¼
11	10	5½ a. m.	.....do.....do.	26.406	26.404	57.57	3460.	23¼	212½
12	10	2 p. m.	.. ..do. .....do.	26.238	26.261	77½	.....	.....	.....
12	11	6 a. m.	....do.....do.	26.447	26.477	54½	3575.	18½	230¾
13	12	5¾ a. m.	.....do.....do.	26.402	26.397	46½.46½	3641.	18½	249¼
14	13	5½ a. m.	.....do.....do.	26.202	26.202	41.41	3820.	25½	274¾
15	14	6 a. m.	.....do..... ....do.	26.080	26.078	43¾	3950.	17¼	292
16	15	6 a. m.	.. ..do..... .do.	25.944	25.942	51.51	3985.	18	310
17	19	8 a. m.	...do.....do.	25 712	25.688	51¼	4250.	25	385

NOTE.—These altitudes were calculated directly from these observations, and some of them modified for non-periodic variation by comparison with the barometric observations kept by the United States medical department at Forts Leavenworth, Snelling, and Kearny. The calculated results so corrected are for station 3, to which add 80 feet for station 5, from which substract 50 feet. For station 7 subtract 50 feet; station 11 subtract 65 feet; station 12 subtract 65 feet; stations 13 and 14, add 150 feet; station 15 add 30 feet, and you have the results give in the column of altitudes.

TABLE III.—*Psychrometrical observations.*

Station.	Date.	Hour.	Air thermometer.	Wet bulb.	Difference.	Force of vapor.	Relative humidity.	Wind. Direction.	Wind. Force.	Extent of cloudy sky in tenths.	Weather and remarks.
	1855.										
Fort Pierre	July 17	12 m.	93½	75¼	18¼	.627	40	.....	.....	2	
Do	....do....	1 p. m.	94	74⅛	19⅞	.561	36	.....	.....	.....	
Do	....do....	2 p. m.	93¼	74½	18¾	.602	34	S. 15 E..	3	8	Cirrro stratus clouds.
Do	....do....	3 p. m.	93⅝	75⅝	18	.644	40	S. 62 E..	2	8	Do.
Do	....do....	4 p. m.	95½	75	20½	.584	36	S. 18 W..	2	7	Cirrus.
Do	....do....	5 p. m.	97¼	77	20¼	.650	37	S. 20 W..	2	8	Cirro stratus.
Do	....do....	6 p. m.	95½	75⅛	20	.608	36	S. 20 W..	2	10	Do.
Do	....do....	7 p. m.	94⅛	74⅛	20	.582	36	S. 20 W..	2	10	Do
Do	....do....	8 p. m.	94¼	74	20¼	.267	34	S. 20 W..	2	10	Do.
Do	....do....	9 p. m.	90	72	18	.589	38	S. 20 W..	1	10	Do.
Do	....do....	10 p. m.	88½	75⅜	18	.708	52	S. 20 W..	6	10	Cumulus; sprinkling of rain.
Do	....do....	11 p. m.	75½	67⅛	8	.567	64	S. 20 W..	6	10	Do. do.
Do	July 18	7 a. m.	72	67½	4½	.614	78	NW.	6	9	
Do	....do....	8 a. m.	71½	64⅛	7	.511	67	N. 17 W.	4	10	Cirro stratus.
Do	....do....	9 a. m.	72¼	64¼	8	.496	63	N. 17 W.	4	10	Do.
Do	....do....	10 a. m.	73¼	64⅛	8⅛	.488	60	N. 17 W.	3	10	Do.
Do	....do....	11 a. m.	74¼	64½	9¾	.472	56	N. 17 W.	4	10	Do.
Do	....do....	12 m.	72¼	62½	9¾	.433	55	N. 17 W.	4	10	Do.
Do	....do....	1 p. m.	73	62½	10½	.427	49	N. 17 W.	4	10	Do.

Do	do	2 p. m.	72¼	61	11¼	.382	49	N. 17 W.	6	10	Do.
Do	do	3 p. m.	72	61½	10½	.407	52	N. 17 W.	6	10	Do.
Do	do	4 p. m.	71	60	11	.371	51	N. 17 W.	4	10	Do.
Do	do	5 p. m.	71	61	10	.402	53	North	4	10	Do.
Do	do	6 p. m.	70	60	10	.382	52	NW	3	10	Do.
Do	do	7 p. m.	69½	61	8½	.424	59	NW	2	10	Do.
Do	do	8 p. m.	68½	61	7½	.435	62	NW	2	10	Do.
Do	do	9 p. m.	68½	59½	9	.393	55	NW	2	10	Do.
Do	do	10 p. m.	68	60	8	.409	60	NW	2	10	Do.
Do	do	11 p. m.	67½	59	8½	.387	57	NW	3	10	Do.
Do	do	12 p. m.									Lost.
Do	July 19	1 a. m.	65½	59½	6	.431	68	NW	3	10	Cirro stratus.
Do	do	2 a. m.	63½	57½	6	.390	67	NW	3	10	Do.
Do	do	3 a. m.									Lost.
Do	do	4 a. m.	62	58	4	.422	75		0	8	Cirrro stratus.
Do	do	5 a. m.	61	57	4	.413	77		0	8	Do.
Do	do	6 a. m.	60½	56	4½	.388	74	North	½	9	Do.
Do	do	7 a. m.	63½	57	6½	.340	65	North	½	10	Do.
Do	do	8 a. m.	64½	57	7½	.325	59	North	½	10	Do.
Do	do	9 a. m.	69	58½	9½	.350	49	North	1	9	Do.
Do	do	10 a. m.	70½	58	12½	.312	41	North	1	10	Do.
Do	do	11 a. m.	72½	59	13½	.320	41	N. 10 E.	2	10	Do.
Do	do	12 m.	74½	59	15½	.296	35	N. 10 E.	2	10	Do.
Do	do	1 p. m.	76	60½	15½	.322	36	N. 10 E.	1	10	Do.
Do	do	2 p. m.	72½	58	12½	.287	36	N. 10 E.	1	10	Do.
Do	do	3 p. m.	72	58½	13½	.309	39	N. 10 E.	1	10	Do.

TABLE III—Continued.

Station.	Date.	Hour.	Air thermometer.	Wet bulb.	Difference.	Force of vapor.	Relative humidity.	Wind. Direction.	Wind. Force.	Extent of cloudy sky in tenths.	Weather and remarks.
	1855.										
Fort Pierre	July 19	4 p. m.	71	58	13	.314	40	N. 10 E..	2	10	Cirro stratus.
Do	do	5 p. m.	69½	57	12½	.302	42	N. 10 E..	2	10	Do.
Do	do	6 p. m.	69	57	12	.304	42	N. 10 E..	2	10	Do.
Do	do	7 p. m.	68¼	58	10¼	.344	50	North ...	2	10	Do.
Do	do	8 p. m.	67¼	58	9¼	.356	53	N. 10 W.	2	10	Do.
Do	do	9 p. m.	65	58	7	.388	63	N. 10 W.	2	10	Do.
Do	do	10 p m.	65	59	6	.421	68	N. 10 W..	2	10	
Do	do	11 p. m.	65	58½	6½	.404	65	Calm....	0	3	Cirro stratus; misty.
Do	do	12 m.	68	57	6	.389	68	Calm....	0	4	Cumulus; misty.
Do	July 20	1 a. m.	60	54	6	.339	66	Calm....	0	2	Do.
Do	do	2 a. m.	55½	53½	2	.386	88	Calm....	0	2	Cirro stratus.
Do	do	3 a. m.	58	53½	4½	.352	73	Calm....	0	3	Do.
Do	do	4 a. m.	56	51½	4½	.323	72	Calm....	0	6	Cirro stratus; misty.
Do	do	5 a. m.	54	51½	2½	.352	85	Calm....	0	6	Do.
Do	do	6 a. m.	58	53	5	.330	69	NW	1	7	Do.
Do	do	7 a. m.	61½	56	5½	.375	69	NW	½	7	Do.
Do	do	8 a. m.	63	57¼	5¾	.392	68	Calm....	0	7	Do.
Do	do	9 a. m.	67	58½	8½	.374	57	South ...	1	10	Fine cirri passing from southeast to northwest.
Do	do	10 a. m.	69½	59½	10	.370	51	South ...	1	9	Do. do.

Do	do	11 a. m.	71	59½	11½	.346	46	South ...	1	7	Do. do.
Do	do	12 m.	78½	60	18½	.330	40	S. 10 E..	1	8	Do. do.
Do	do	1 p. m.	74¼	62	12¼	.384	46	S. 10 E..	1	10	Detached masses of cirri passing from southeast to west.
Do	do	2 p. m.	76	62	14	.354	41	S. 10 E..	1	9	Do. do.
Do	do	3 p. m.	76	61	15	.358	44	S. 40 E..	1	6	From the south to the north a broad band of cirro stratus, and in the east and west detached masses of cirri.
Do	do	4 p. m.	76	60½	15½	.325	36	S. 40 E..	1	6	Do. do.
Do	do	5 p. m.	75	59	16	.320	35	S. 40 E..	1	5	Light cirro stratus, with masses passing from the southeast to the northwest.
Do	do	6 p. m.	73¾	59	14¾	.308	36	S. 40 E..	1	3	Cirro stratus around the horizon, especially at the south; detached masses overhead.
Do	do	7 p. m.	72	57½	10½	.377	36	S. 50 E..	2	2	Cirro stratus around the horizon and running out in points towards the zenith.
Do	do	8 p. m.	69	58½	10½	.360	50	S. 50 E..	2	1	Light cirri overhead.
Do	do	9 p. m.	66	57	9	.349	54	S. 50 E..	2	5	Long lines of cirri across the zenith.
Do	do	10 p. m.	64	56	8	.342	58	S. 50 E..	2	5	Do.
Do	do	11 p. m.	63	54	9	.292	52	S. 50 E..	2	3	Cirro stratus.
Do	do	12 m.	62	54	8	.306	56	S. 50 E..	2	3	Do.
Do	July 21	1 a. m.	59	53½	5½	.314	59	S. 50 E..	2	3	Do.
Do	do	2 a. m.	57½	54	3½	.362	78	S. 50 E..	1	1	Do.
Do	do	3 a. m.	60½	56	4½	.354	73	Calm....	0	1	Do.
Do	do	4 a. m.	58¾	55	3¾	.368	80	SE	1	1½	Do.
Do	do	5 a. m.	57½	55	2½	.364	84	S. 10 E ..	1	1½	Do.
Do	do	6 a. m.	63	57¼	5¾	.368	68	SE	1	1½	Do.
Do	do	7 a. m.	64¼	58½	5¾	.412	69	SE	1	2	Cirrus clouds around the horizon; detached fragments passing from southeast to northwest.
Do	do	8 a. m.	68½	60	8½	.400	58	SE	1	1	Do. do.
Do	do	9 a. m.	71½	62	9½	.406	54	SE	2	½	Very light cirri moving to north; very high.
Do	do	10 a. m.	74¾	61½	13¼	.366	43	SE	1	2	Cirro stratus in the southeast.
Do	do	11 a. m.	76½	62	13½	.358	40	SE	1	0	
Do	do	12 m.	78½	62½	16	.354	37	SE	1	1	Very light cirri passing from southeast to northwest.

TABLE III—Continued.

Station.	Date.	Hour.	Air thermometer.	Wet bulb.	Difference.	Force of vapor.	Relative humidity.	Wind. Direction.	Wind. Force.	Extent of cloudy sky in tenths.	Weather and remarks.
	1855.										
Fort Pierre	July 21	1 p. m.	79½	64½	15	.402	40	South ...	1	4	Very light cirri passing from southeast to northwest.
Do	do	2 p. m.	80½	64½	16	.382	38	South ...	1	7	Cirro stratus.
Do	do	3 p. m.	80	63½	16½	.363	35	South ...	1	7	Do.
Do	do	4 p. m.	79½	63	16½	.354	35	South ...	1	7	Do.
Do	do	5 p. m.	81½	63	17½	.330	31	South ...	1	7	Do.
Do	do	6 p. m.	79½	62½	17½	.340	34	S. 10 E ..	1	6	Cirro stratus around the horizon; detached fragments overhead; very high and white.
Do	do	7 p. m.	79½	62½	17	.340	34	S. 40 E..	1	7	Light cumulus clouds floating from southeast to the north.
Do	do	8 p. m.	76¼	61½	14¾	.406	45	S. 40 E..	2	4	Cirri passing from southeast to northwest; some in the south stationary.
Do	do	9 p. m.	74	61½	12½	.364	44	S. 40 E..	3	4	Cumulus overhead; cirro stratus in the southeast and northwest.
Do	do	10 p. m.	72	61	11	.368	50	S. 40 E..	4	4	Do. do.
Do	do	11 p. m.	71	61	10	.378	53	S. 40 E..	4	4	Do. do.
Do	do	12 m.	Lost.....		Lost.....			North ...	4	4	Cirro stratus and cumulus in south.
Do	July 22	1½ a. m.	68	61½	6½	.452	67	North ...	4	2	Misty and lightning in the horizon.
Do	do	2 a. m.	67	61½	5½	.468	72	North ...	3	½	Misty.
Do	do	3 a. m.	67½	61	6½	.448	68	North ...	2	1	Do.
Do	do	4 a. m.	65	61	4	.478	78	Calm....	0	4	Cumulus.
Do	do	5 a. m.	64	58	6	.388	68	Calm....	0	4	Do.
Do	do	6 a. m.	66	60	6	.416	70	Calm....	0	4	Cirro stratus in the east; cumulus and a few cirri in the northwest.
Do	do	7 a. m.	66½	60½	6	.456	70	Calm....	0	4	Do. do.

Do	do	8 a. m.	71	63	8	.460	62	Calm	0	2	Very light cirro stratus in the east.
Do	do	9 a. m.	74	64	10	.468	55	Calm	0	2	Do.
Do	do	10 a. m.	78½	67¼	11¼	.514	54	SE	½	6	Cirro stratus, with a few light cumulus clouds in the eastern horizon.
Do	do	11 a. m.	80½	67	13½	.482	46	SE	½	7	Do. do.
Do	do	12 m.	82¼	66½	15¾	.430	39	SE	½	7	Cirro stratus with a few cumulus clouds in the south.
Do	do	1 p. m.	84	66	18	.402	34	East	½	7	Do. do.
Do	do	2 p. m.	86½	66½	20	.374	30	East	1	5	Cirro stratus stretching from east to west.
Do	do	3 p. m.	86	64	22	.310	25	East	1	3	Cirrus in the east; cumulus in the southwest.
Do	do	4 p. m.	86	64	22	.310	25	East	1	3	Rain about twenty miles down the river.
Do	do	5 p. m.	86	66	20	.376	30	S. 40 E.	1	3	Cumulus in southwest; cirrus in the east.
Do	do	6 p. m.	83½	65½	18	.360	34	S. 20 E.	1	3	Do. do.
Do	do	7 p. m.	81	66	15	.422	41	S. 20 E.	1	3	Do. do.
Do	do	8 p. m.	77½	68	9½	.558	60	S. 20 E.	1	4	Do. do.
Do	do	9 p. m.	75	66½	8½	.526	61	S. 20 E.	1	3	Cirro stratus.
Do	do	10 p. m.	73¼	65½	7¾	.522	65	S. 20 E.	1	2	Do.
Do	do	11 p. m.	73	65	8	.516	64	S. 20 E.	1	1	Do.
Do	do	12 m.	73½	64½	9	.484	59	S. 20 E.	1	0	Clear.
Do	July 23	1 a. m.	66	62½	3½	.518	81	NNW	1	0	Do.
Do	do	2 a. m.	66½	63	3½	.534	81	NNW	1	0	Do.
Do	do	3 a. m.	65	62½	2½	.532	86	NNW	1	0	Do.
Do	do	4 a. m.	63¼	61½	1¾	.508	90	0	0	0	0.
Do	do	5 a. m.	61½	57½	4	420	77	0	0	½	Light cirri.
Do	do	6 a. m.	64¼	62	2¾	.510	85	0	0	0	0.
Do	do	7 a. m.	68½	64	4½	.546	78	0	0	0	
Do	do	8 a. m.	73	65½	7½	.522	64	South	½	0	
Do	do	9 a. m.	77½	69	8½	.590	62	South	½	0	

TABLE III—Continued.

Station.	Date.	Hour.	Air thermometer.	Wet bulb.	Difference.	Force of vapor.	Relative humidity.	Wind. Direction.	Wind. Force.	Extent of cloudy sky in tenths.	Weather and remarks.
	1855.										
Fort Pierre	July 23	10 a. m.	82¼	67½	14¾	.496	47	South ...	½	0	
Do	do	11 a. m.	84½	67	17½	.406	35	South ..	1	0	
Do	do	12 m.	84½	67	17½	.406	35	South ...	1	0	
Do	do	1 p. m.	88	68	20	.418	32	South ...	1	0	
Do	do	2 p. m.	88½	69	19½	.444	34	South ...	1	¼	Cirrus.
Do	do	3 p. m.	89	68½	20½	.416	30	S. 45 E ..	2	⅛	Do.
Do	do	4 p. m.	88½	69½	19½	.432	31	S. 45 E ..	2	⅛	Cirrus in the east.
Do	do	5 p. m.	87½	68½	19	.428	33	S. 45 E ..	2	⅛	Do.
Do	do	6 p. m.	86	68½	17½	.446	36	S. 45 E ..	2	⅛	Do.
Do	do	7 p. m.	83	70	13	.552	50	S. 45 E ..	2	0	Perfectly clear.
Do	do	8 p. m.	80	68½	11½	.536	53	S. 45 E ..	2	0	Do.
Do	do	9 p. m.	78½	68	10½	.544	56	S. 45 E ..	1	0	
Do	do	10 p. m.	75½	67½	8	.566	65	S. 45 E ..	1	0	
Do	do	11 p. m.	73½	67½	6	.602	72	S. 45 E ..	1	0	
Do	do	12 m.	72	67½	5½	.624	78	North ...	1	0	
Do	July 24	1 a. m.	70½	67	3½	.614	82	North ...	1	0	
Do	do	2 a. m.	71	67	4	.610	81	North ...	1	0	
Do	do	3 a. m.	69	66¼	2¾	.606	86	0	0	¼	Misty
Do	do	4 a. m.	68	66	2	.618	91	S. E.....	½	1	Do.

Do	do	5 a. m.	71	67	4	.610	81	0	0	0	
Do	do	6 a. m.	74	69	5	.634	77	0	0	0	
Do	do	7 a. m.	77	68	9	.561	61	0	0	0	
Do	do	8 a. m.	82¼	70½	12½	.582	54	0	0	0	
Do	do	9 a. m.	84½	69	15½	.496	48	S. 45 E..	1	1	Cumulus in the northeast; light cirri in the southeast.
Do	do	10 a. m.	86½	69	17½	.452	36	S. 45 E..	1	1	Do. do. do.
Do	do	11 a. m.	87½	69½	18	.484	37	S. 45 E..	1	1	Light cirri passing from the east to the west; some cumulus in the south.
Do	do	12 m.	89	69½	19½	.466	34	S. 45 E..	1	2	Do. do.
Do	do	1 p. m.	90½	68½	22	.430	28	S. 45 E..	1	2	Cirro stratus in the east; cumulus in the south.
Do	do	2 p. m.	91	69½	21½	.418	29	S. 45 E..	1	2	Cirro stratus; clouds in the south and west.
Do	do	3 p. m.	92	70	22	.432	29	S. 45 E..	1	2	Do. do.
Do	do	4 p. m.	91½	70	21½	.436	30	S. 45 E..	1	2	Do. do.
Do	do	5 p. m.	91	70	21	.452	30	S. 45 E..	1	1	Cumulus and cirro stratus; light cirri passing to the west.
Do	do	6 p. m.	88½	70	18½	.492	36	S. 45 E..	2	1	Do. do.
Do	do	7 p. m.	86	70	16	.522	42	S. 45 E..	2	0	
Do	do	8 p. m.	82½	70½	12½	.582	53	S. 45 E..	3	0	
Do	do	9 p. m.	81	69	12	.546	54	S. 45 E..	3	0	
Do	do	10 p. m.	79	68	11	.544	55	S. 45 E..	3	2	Light cumulus in the northeast, and cirrus passing from southeast to the west.
Do	July 25	7 a. m.	75	69	6	.624	74	S. 45 E..	2	8	Cirro stratus.
Do	do	2 p. m.	92	73	19	.492	36	S. 45 E..	3	10	Cumulus passing to the west.
Do	do	9 p. m.	75	64½	10½	.464	54	S. 45 E..	7	10	Rain commenced 4½ o'clock, ended 7, about 15 miles to southeast rained hard with large hail stones; quantity 0.05.
Do	July 26	7 a. m.	71½	66½	5	.582	75	S. 45 E..	2	1	Cirro stratus very light.
Do	do	2 p. m.	89	73	16	.590	43	South ...	1	2	Do
Do	do	9 p. m.	80½	72	8½	.656	64	S. 45 E..	1	3	Cirri in the southest; cirro stratus in northwest.
Do	July 27	7 a. m.	72	65	7	.492	67	N. 46 E..	4	½	Light cirri passing from northeast to southwest.
Do	do	2 p. m.	83	70	13	.562	50	NNE.....	3	10	Cirro stratus.

TABLE III—Continued.

Station.	Date.	Hour.	Air thermometer.	Wet bulb.	Difference.	Force of vapor.	Relative humidity.	Wind. Direction.	Wind. Force.	Extent of cloudy sky in tenths.	Weather and remarks.
	1855.										
Fort Pierre	July 27	9 p. m.	67½	60⅝	7	.432	65	N. 45 E..	1	7	Cirro stratus; cumulus clouds about sunset.
Do	July 28	7 a. m.	65	60	5	.448	72	N. 20 W.	1	0	
Do	do	2 p. m.	74	63	11	.428	52	SE	2	8	Cirro stratus moving from west to east; high.
Do	do	9 p. m.	71	61	10	.398	53	ENE.	4	10	Cirro stratus and cumulus.
Do	July 29	7 a. m.	65	58½	6½	.400	66	ENE.	4	1	Cirri.
Do	do	2 p. m.	80½	62	14½	.365	29	S. 30 W..	1	4	Cirrus and cumulus.
Do	do	9 p. m.	72	68	9	.454	58	SE.	1	0	
Do	July 30	7 a. m.	67	64	3	.552	84	S. 10 E..	4	10	Nimbus; rained in the night; quantity 0.28.
Do	do	2 p. m.	79	70	9	.606	62	South ...	6	3	Cirrus.
Do	do	9 p. m.	74	68	6	.604	72	ENE.. ..	2	0	No clouds.
Do	July 31	7 a. m.	68	65	3	.576	84	South....	2	10	Cirro stratus.
Do	do	2 p. m.	84	74	10	.712	63	S. 15 E..	2	3	Cirrus.
Do	do	9 p. m.	81	73½	7½	.716	68	North ...	4	10	Cirro stratus.
Do	August 1	7 a. m.	71	67	4	.610	81	North ...	5	10	Do.
Do	do	2 p. m.	93	76	17	.664	43	NE	5	10	Do.
Do	do	9 p. m.	71½	67	4½	.600	78	South....	3	4	Cumulus.
Do	August 2	7 a. m.	70	66½	3½	.594	82	NE.	3	10	Cirro stratus.
Do	do	2 p. m.	81	72	9	.672	64	NW.	2	3	Do.
Do	do	9 p. m.	77	71	6	.660	74	NW.	4	0	

Do	August 3	7 a. m.	73	68	5	.616	76	NW.	4	1	Cirrus.
Do	do	2 p. m.	73½	64	8½	.464	58	NE.	3	4	Cirro stratus.
Do	do	9 p. m.	68	61½	6½	.458	67	Calm		1	Cirrus.
Do	August 4	7 a. m.	66	65	1	.584	94	NE.	4	9	Cirro stratus.
Do	do	2 p. m.	78	73	5	.748	78	NE.	4	2	Cumulus.
Do	do	9 p. m.	72½	69	3½	.660	82	NE.	3	9	Do.
Do	August 5	7 a. m.	67	67	0	.664	100	SE.	2	10	Cumulus; dense fog.
Do	do	2 p. m.	79	74½	4½	.784	80	SE.	3	6	Do. do.
Do	do	9 p. m.	73	70	3	.688	86	0	0	1	Cirrus.
Do	August 6	7 a. m.	70½	67½	3½	.628	85	SE.	2	1	Cumulus in the south.
Do	do	2 p. m.	85½	74	11½	.680	56	SE.	1	2	Cirrus.
Do	do	9 p. m.	80½	73	7½	.732	68	SE.	3	7	Cumulus.
Do	August 7	7 a. m.	73	70	3	.688	86	SW.	3	10	Nimbus; rain; quantity 1 in. 7.10.
Do	do	2 p. m.	81	72	9	.668	63	SW.	2	0	
Do	do	9 p. m.	71	63	8	.472	62	SW.	4	0	
Do	August 8	7 a. m.	71	67	4	.610	80	East	1	0	
Do	do	2 p. m.	79	68	11	.538	55	East	1	2	Cirrus.
Do	do	9 p. m.	72	66	6	.550	72	East	1	3	Do.

TABLE IV.—*Elastic force of vapor in the atmosphere, in inches of the barometer.*

Station.	Date.	Hours, A. M.												Hours, P. M.											
		1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
	1855.																								
Fort Pierre	July 17	....	....	...	....	....	....	....	....	....	....	....	.627	.561	.602	.644	.584	.650	.608	.582	.567	.589	.708	.567	.614
Do.....	July 18	....	....	....	....	....	....	.614	.511	.496	.488	.472	.433	.421	.382	.407	.371	.402	.382	.424	.435	.393	.409	.387	....
Do.....	July 19	.431	.390	....	.422	.413	.388	.340	.325	.350	.312	.320	.296	.322	.287	.309	.314	.302	.304	.344	.356	.388	.421	.404	.389
Do.....	July 20	.389	.386	.352	.323	.352	.330	.375	.392	.374	.370	.346	.330	.384	.354	.358	.325	.320	.303	.377	.360	.349	.342	.292	.306
Do	July 21	.314	.362	.354	.368	.364	.368	.412	.400	.406	.366	.358	.354	.402	.382	.363	.354	.330	.340	.340	.406	.364	.368	.378	....
Do.....	July 22	.452	.463	.448	.478	.388	.416	.450	.460	.468	.514	.482	.430	.402	.374	.310	.310	.376	.380	.422	.558	.526	.522	.516	.484
Do.....	July 23	.518	.534	.532	.508	.420	.510	.546	.522	.590	.490	.406	.406	.418	.444	.416	.432	.428	.446	.552	.536	.544	.566	.602	.624
Do.....	July 24	.614	.610	.606	.618	.610	.634	.561	.584	.496	.452	.484	.466	.480	.418	.432	.436	.452	.492	.522	.582	.546	.544	....	....
Mean	.....	.445	.458	.458	.455	.425	.441	.472	.456	.454	.428	.410	.418	.405	.405	.405	.391	.407	.407	.445	.475	.456	.485	.450	.483

Mean of all, .439 inches.

TABLE V.

Elastic force of vapor in inches.

	7 a. m.	2 p. m.	9 p. m.	Mean.
1855.				
July 17	....	.602	.539	.570
18	.614	.382	.393	.463
19	.340	.287	.388	.338
20	.375	.354	.349	.359
21	.412	.382	.364	.386
22	.456	.374	.526	.452
23	.546	.444	.544	.511
24	.561	.418	.546	.508
25	.624	.492	.464	.526
26	.582	.590	.656	.609
27	.493	.562	.432	.495
28	.448	.428	.398	.425
29	.400	.305	.454	.386
30	.552	.606	.604	.582
31	.576	.712	.716	.668
August 1	.610	.664	.600	.625
2	.594	.672	.660	.642
3	.616	.464	.458	.513
4	.584	.748	.660	.664
5	.664	.784	.668	.712
6	.628	.680	.732	.680
7	.688	.668	.472	.609
8	.610	.538	.550	.566
Mean:	**.544**	**.563**	**.530**	**.546**

TABLE VI.—*Barometer No.* 1014, *corrected for temperature.*

Date.	Barometer observations, A. M.												Barometer observations, P. M.											
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1855.																								
July 17.....	.....	....	....	....	....	....	....	....	....	....	....	28.361	.385	.322	.354	.160	.224	.210	.257	.253	.258	.212	.275	....
18.....	.....	....	....	....	....	....	3.57	.380	.412	.466	.507	.512	.521	.532	.538	.553	.528	.560	.560	.591	.578	.590	.599	....
19.....	28.625	.584	....	.657	.657	.683	.672	.708	.692	.690	.692	.679	.680	.660	.668	.660	.666	.676	.688	.680	.708	.698	.698	.702
20.....	28.713	.695	.698	.699	.697	.716	.716	.718	.718	.750	.718	.699	.682	.659	.629	.615	.622	.607	.592	.592	.603	.614	.613	.614
21.....	28.616	.603	.598	.594	.599	.600	.579	.558	.598	.535	.531	.496	.488	.489	.485	.424	.400	.484	.482	.363	.386	.369	.408	....
22..... ...	.....	....	.425	.431	.431	.458	.440	.452	.457	.446	.441	.445	.428	.424	.491	.418	.410	.411	.412	.421	.428	.433	.432	.483
23.....	28.486	.482	.486	.480	.472	.532	.486	.506	.502	.494	.501	.494	.469	.468	.457	.443	.428	.421	.406	.472	.355	.416	.369	.430
24.....	28.432	.421	.395	.402	.386	.398	.394	.360	.324	.344	.318	.308	.305	.279	.263	.232	.231	.209	.214	.216	.219	.246	....	....
Means....	78.574	.547	.520	.544	.540	.564	.520	.525	.520	.546	.529	.499	.488	.479	.473	.425	.438	.447	.459	.448	.442	.448	.484	.532

Mean of all 28.486 inches.

TABLE VII.—*Barometer No.* 1013, *corrected for temperature.*

Date.	Barometer observations, A. M.												Barometer observations, P. M.											
	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.	1.	2.	3.	4.	5.	6.	7.	8.	9.	10.	11.	12.
1855.																								
July 17....	....	....	....	....	.....	.....	.....	.....	....	....	....	28.349	.475	.318	.246	.318	.244	.259	.269	....	.240	.210	....	....
18....	....	....	....	....	.....	.....	.....	28.290	.300	.426	.423	.450	.438	.448	.431	.435	.492	.492	.672	.509	.582	....	....	....
19....	....	....	....	....	28.662	.662	.674	.681	.688	.686	.689	.687	.652	.660	.666	.687	.772	.677	.664	.658	.662	.670	....	....
20....	....	....	....	....	28.712	.626	.716	.725	.708	.709	.717	.709	.687	.690	.650	.661	.614	.608	.616	.594	.603	.659	.643	.634
21....	....	....	....	....	28.631	.570	.575	.569	.547	.540	.534	.504	.471	.431	.477	.433	.419	.395	.399	.401	.400	.416	.412	....
22....	....	....	....	....	.....	28.442	.432	.445	.436	.447	.440	.427	.447	.430	.370	.420	.398	.397	.397	.404	.405	.428	.424	.436
23....	....	....	....	....	.....	.....	28.439	.490	.477	.477	.468	.427	.416	.418	.416	.408	.405	.397	.379	.409	.391	.399	.381	...
24 ...	....	....	....	....	.....	28.369	.368	.340	.339	.346	.321	.311	.290	.266	.261	.285	.247	.208	.183	.216	.211	.218	....	...
Means.....	....	....	....	....	28.668	.534	.534	.506	.499	.519	.512	.483	.484	.457	.439	.449	.449	.438	.447	.457	.418	.428	.465	.535

TABLE VIII.

Reduced barometric readings, from which the altitude of Fort Pierre is computed.

Barometer No. 1014.		7 a. m.	2 p. m.	9 p. m.	Mean.
1855.					
July	17	.....	28.322	28.258	.....
	18	28.357	.532	.578	28.489
	19	.672	.660	.708	.680
	20	.716	.659	.603	.659
	21	.579	.489	.386	.485
	22	.440	.424	.428	.431
	23	.486	.468	.355	.436
	24	.394	.279	.219	.297
	25	.214	.184	.161	.186
	26	.199	.249	.267	.238
	27	.281	.313	.350	.315
	28	.462	.461	.529	.484
	29	.554	.545	.526	.542
	30	.437	.483	.391	.437
	31	.364	.347	.352	.354
August	1	.415	.284	.289	.329
	2	.342	.441	.453	.412
	3	.635	.633	.696	.655
	4	.637	.616	.592	.615
	5	.568	.524	.485	.526
	6	.490	.436	.322	.416
	7	.310	.285	.309	.303
	8	.413	.504	.....	.....
	Mean	28.453	.438	.416	28.436

Corresponding mean air temperature 77°.

TABLE IX.

Daily curve of pressure and the corrections to be applied to the readings at the several hours.

5 a. m.	28.485	+.000
6 a. m.	.495	+.005
7 a. m.	.505	+.019
8 a. m.	.515	+.029
9 a. m.	.525	+.039
10 a. m.	.540	+.054
11 a. m.	.550	+.044
12 m.	.500	+.014
1 p. m.	.488	+.002
2 p. m.	.465	—.023
3 p. m.	.450	—.038
4 p. m.	.430	—.058
5 p. m.	.438	—.050
6 p. m.	.447	—.038
7 p. m.	.455	—.031
8 p. m.	.465	—.021
9 p. m.	.475	—.013
10 p. m.	.488	+.003
Mean	28.485	.....

NOTE.—The corrections to be applied with contrary sign.

APPENDIX E.

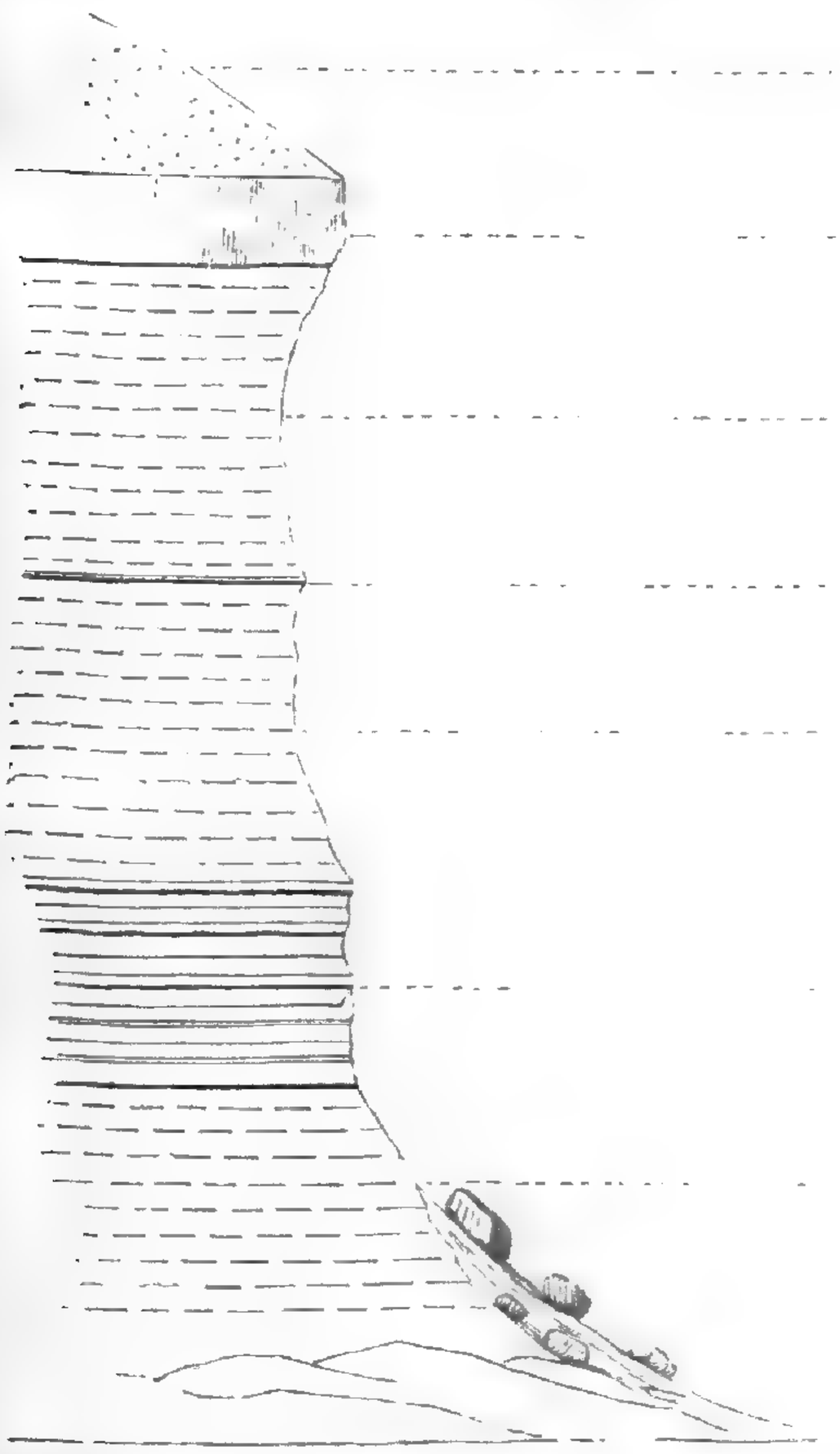
GEOLOGICAL NOTE ON SECTION IN RAVINE OF L'EAU QUI COURT RIVER, BY WM. P. BLAKE.—GEOLOGICAL NOTES, &C., ON NEBRASKA, BY DR. F. V. HAYDEN.

Observations on the Geological specimens collected by Lieutenant G. K. Warren from the bluffs of a ravine in the Mauvaises Terres. By William P. Blake.

WASHINGTON, D. C., *March* 15, 1856.

DEAR SIR: The collection of rocks which you made from the bluffs of a ravine five or six miles distant from the stream known as *l'Eau qui Court* is interesting and important, although, from the circumstances under which you were placed, the specimens are not large or numerous. Their value, however, consists in the fact that they represent the character of the strata in their order of superposition, and permit a sectional representation to be made, which, from your descriptions and observations, I judge will present very nearly the nature of the strata for a wide area in that region. Until this time we have been without a suite of specimens from these strata, and without any very definite knowledge of their mineral characters.

From these specimens and your explanations I have constructed the annexed sectional view of the face of the bluff:



The thickness thus represented is about sixty feet, and consists, as will be seen, of light colored friable sandstones; sand loosely coherent

and of marly clays. No coarse sandstones or beds of conglomerate are presented; and the series would thus appear to have been deposited in comparatively quiet water without violent currents. I now present a brief description of the specimens collected from the strata as they succeed each other upwards from the base of the bluff.

a. From the base, a thickness of 15 *feet exposed to view.*

This specimen is partly in powder and is very friable. Its color is white, and when examined with a microscope is seen to consist principally of grains of white and translucent or transparent quartz, very much rounded and worn, as if by long attrition. They are surrounded and cemented together by an opaque white mass which shows fibrous crystalizations and resembles a soluble salt which has effloresced by exposure to the air. This, however, is not removed by boiling water, but dissolves rapidly in clorhydric acid with effervescence, and the solution gives a white precipitate with carbonate of ammonia. The white substance, therefore, is probably carbonate of lime.

b. 2. *Specimen from the bottom.*

The specimen has a light ash color, and consists, in great part, of alumina, [clay.] According to the label it forms thin strata only a few inches thick, alternating with layers of sand, forming a combined thickness of about ten feet. When treated with acid it effervesces, and the separation of the particles shows the presence of very small silicious grains, rounded like those in the preceeding specimen. The mass also contains a considerable portion of oxide of iron, and it may be called an arenaceous marl.

c. 3. *Stratum from bottom.*

Loose sand; no specimen obtained; thickness about 15 feet.

d. 4. *Stratum from base.*

This is an ash colored powder, consisting in great part of clay: silicious grains are also present, and are coarser than those seen in the specimen from *b*. The lable with this states that the larger is of very variable thickness, and so soft that it was not possible to obtain a coherent lump. I have represented it in the section as three inches in thickness, which you inform me is its probable average.

I find in this powder several minute but beautiful shells and fragments of larger ones. The shells prove on inspection to belong to two genera, Helix and Planorbis. The first is a land shell, and the second, or the Planorbis, inhabits fresh water ponds or lakes. The fresh water origin of these strata is thus indicated: the largest of the shells is less than one-eighth of an inch in diameter, but the form and markings are perfectly preserved: the color is white, and they are filled with portions of the fine white clay in which they were imbeded. It is most probable that these shells do not correspond to any described

species, but there has not been sufficient time to make the necessary comparisons. Dr. Charles Girard, to whom I have exhibited them, coincides with me in the opinion that they are new, and we propose for them provisonally the names *Helix socialis*, and *Planerbis antiqua*.

e. 5. *Stratum from bottom.*

Land 10 to 15 feet thick; not represented in the collection.

f. 6. *Stratum from bottom.*

This specimen is a compact white or grayish-white calcareous sandstone. The silicious grains are very uniform in size; quite small and much rounded. They are nearly all of translucent or transparent quartz, and are cemented by carbonate of lime, which is present in such quantity that the prints or beds of the rounded grains are left when they are removed by friction. This sandstone bears a close resemblance to some specimens from the Llano Estacado, brought in by Captain Pope, from the line of exploration near the 32d parallel. It is the hardest specimen of the series, and probably acts as a sort of roof or protection to the underlying strata, projecting beyond them, like the eaves of a house, and preventing their rapid degradation by the weather. You inform me that this is the case, and that its thickness is about five feet.

g. Upper layer of sand.

I judge from your description that this upper layer of sand, which varies from 50 to 100 feet in thickness, is an accumulation of drift sand or dunes, which was not laid down under water in the position which it now occupies. The rounded sloping surface which it presents towards the edge of the bluff, shows its loose condition, and is additional evidence of its drifted character. Under a glass, the sand resembles the drifted sand from the Colorado desert, but it is not so coarse, nor does it present such a variety of colored grains of agate and hard volcanic rocks. The grains are remarkably even in size, and are very clean and free from dust. When treated with acid there is no effervescence, and in this respect it differs from the sand of the desert, and from that of the sand hills on the Llano Estacado.

The specimens from this section of the bluff are accompanied by two others, one from an outcrop "near the summit of a ridge in the vicinity of Dog's Ear butte," and another from the surface of the Sand Hills [*Les buttes de Sable,*] showing the nature of the soil. The first mentioned specimen is a calcareous sandstone, almost identical in its appearance and mineral characters with the sandstone of the upper stratum of the bluff, [*f* in the section.] One of the fragments, however, is more highly charged with carbonate of lime, which in some places appears in layers or seams, as if it had been infiltrated.

I suppose that it would be desirable to subject the "soil" to analysis, but on examining it, I concluded that its composition was sufficiently revealed by the aid of the eye alone. It is almost entirely *sand*, and

differs from that already described only in containing a little dust, and a very little organic matter—particles of the roots and grasses—which can readily be blown out by the breath. The sand is perfectly loose, and may be poured from one paper to another. It is nearly all silex, and even does not effervesce with acid.

It is wonderful that even the scanty vegetation you describe should exist on such a barren foundation.

Respectfully and truly, yours,

W. P. BLAKE,
Geologist of the office of the United States Pacific Railroad Explorations and Surveys.

Lieut. G. K. WARREN,
United States Topographical Engineers.

WASHINGTON, D. C.,
March 15, 1856.

SIR: I herewith present a brief sketch of the geological and physical features of the region of the upper Missouri, with some notes on its soil, vegetation, animal life, &c.

Very respectfully, your obedient servant,

F. V. HAYDEN.

Lieut. G. K. WARREN,
United States Topogrophical Engineers.

The vast extent of country drained by the great hydrographical basin of the Missouri, may be characterized as one principal system of waters, the Missouri river and its larger tributaries as systems. The Missouri river or principal system rises in the main chain of the Rocky mountains, runs an east or slightly northeast course to the confluence of White Earth river near the 49th parallel, the most northern point on the river; then changing its course it flows in a southeasterly direction to its confluence with the Mississippi, in latitude 38° 50′ 50″. Its topography is quite well understood as far as Fort Benton, and in the vicinity of the mountain passes, but of its sources very little as yet is definitely known.

Then come the principal tributaries of the Missouri river, which I have called sub-systems, or subsidiary hydrographical basins, a portion of which I will mention as illustrative of this paper. Commencing on the right side in ascending the Missouri, we have—

1. The sub-system of the Platte river, an important branch, draining an immense area, which also rises in the main chain of the Rocky mountains and empties into the Missouri in latitude 41° 3′ 24″.

2. The sub-system of the *L' Eau qui Court*, or Running Water, which takes its rise in the eastern portion of the Black Hills, drains an area of country about three hundred miles in length and sixty in breadth, flows mostly through the cretaceous and tertiary formations. This has been very little explored.

3. The sub-system of White river, which also rises in the eastern

portion of the Black Hills, and flows through the remarkable mammalian cemetery or tertiary basin, draining an area of two hundred and fifty miles in length and fifty in breadth, empties into the Missouri in latitude 43° 41′. It has been partially explored.

4. The Teton, or Bad river of the Sioux, an inferior sub-system, rises in the eastern portion of the Bad Lands, drains an area of one hundred miles in length and thirty in breadth, flows through the sterile clays of the cretaceous formation, and empties into the Missouri four miles below Fort Pierre, near latitude 44° 23′ 28″.

5. The sub-system of the Shyenne, a river of considerable size, takes its rise in the western portion of the Black Hills, the left fork of which passes through the northern portion of the same spur and empties into the Missouri near latitude 44½°. This river drains an area of about three hundred and fifty miles in length and sixty to eighty in breadth, and flows for the most part through the sterile clays of the cretaceous formation. It has been partially explored.

6. Passing over the Moreau, Grand, and Cannon Ball rivers, which take their rise in the prairie near the eastern base of the Black Hills, and are less important streams, we come to the sub-systems of the Little Missouri, which rises in the eastern portion of the Black Hills, flows through the great Lignite Tertiary basin, draining an area of about two hundred and fifty miles in length and fifty in breadth, and empties into the Missouri near latitude 47½°. As yet it is very little known.

In latitude 48°, the Missouri bifurcates the right fork or Yellowstone, draining an immense region, to the south and west, of which very little is known; and the left fork of the Missouri, draining the country further west and north near the base of the mountains. The left fork of the Missouri contains a less volume of water and has a far less rapid current than the Yellowstone.

On the left side I will only mention the two sub-systems of the James and Big Sioux rivers, which have been quite thoroughly explored by Nicollet and others, and drain a much more fertile region than those before mentioned.

The above gives a brief geographical outline of the basin drained by the Missouri system of waters.

Geologically the Missouri country, from the mouth of the Platte to the Rocky mountains, may be characterized by three principal divisions, representing three geological systems.

1. The Carboniferous system, the upper members of which are very well developed at the mouth of the Platte, and extend to a point about thirty miles above Bellevue, Nebraska. Here the limestone strata dip beneath the bed of the river and are succeeded by a bed of yellowish sandstone, the exact age of which is not known, but probably belongs to the Cretaceous system.

2. The Cretaceous system, which is positively known to exist at the mouth of Big Sioux, and is the basis formation thence to the mountains, supporting the Tertiary, or 3d system, which covers a very large area, and may be separated into three principal basins.

1. The Tertiary basin of White river, which, with its outlines, ex-

tends over an area of two hundred and fifty miles in length and fifty to sixty in breadth.

2. The great Lignite basin, commencing on the Missouri river near the mouth of Cannon Ball river, and reaching to the mouth of Muscleshell river, a distance of nearly eight hundred miles in a straight line, extends up the Yellowstone six or seven hundred miles; its limits in that direction not known. In the summer of 1854, I traced it to the mouth of the Big Horn river, and obtained through the Crow Indians undoubted Tertiary fossils from a point two hundred miles further up the river. Its boundaries have not yet been determined, but may be estimated to cover an area, with very little interruption, of from four to six thousand square miles.

3. The "Bad Lands of the Judith," which seems to be a distinct basin, probably an estuary deposite, the exact age of which is not determined, covers an area of about 40 miles in length, and 10 to 20 in breadth. The details of the geology of these systems I have reserved for a succeeding report.

The whole region watered by the Missouri also presents many zoological and botanical characteristics which are peculiar, and even in its ancient fauna and flora, it exhibits forms and types found in no other geological district.

From the mouth of the Missouri to the confluence of the Platte, the timber along the river is very abundant and luxuriant, and the upland prairie usually presents a very good growth of several species of forest trees. But in the vicinity of Council Bluffs it diminishes in size, quantity, and value. The upland prairies furnish very little timber excepting that which skirts the streams, and that is not luxuriant; and the wide fertile bottoms of the Missouri are covered with tall sedge grass and flowering plants, instead of the gigantic forest trees which form so conspicuous a feature in the scenery near Kansas river. Here the rocky ledges of the limestone of the coal system cease, and with them many species of forest trees which exhibit a healthy growth below the Platte.

At Council Bluffs the river bottom becomes gradually wider, and extends without interruption to Floyd's Bluff, reaching its maximum width near the Little Sioux. At Floyd's Bluff the hills approach the river, and are cross-sectioned by it, and the wide river bottom appears on the opposite side. Here bluffs, as they are usually called, extend along the river about eight miles, to the mouth of the Big Sioux river. At this point the magnificent Vermilion prairie commences, and continues with very little interruption to Dorion's Hills, a distance of over 60 miles. All these bottoms are covered with a most luxuriant growth of grass and flowering plants, often rising to the height of 8 or 10 feet, effectually concealing a horse and his rider. They possess an inexhaustible fertility, as the vegetation indicates, with a subsoil composed of a mixture of the calcareous and silicious marls of the Tertiary, and the clays of Cretaceous beds brought down by the river from the upper Missouri. The whole is covered with a rich vegetable mould, formed by the annual decay of the enormous growth of vegetation.

The forest trees from Council Bluffs to Dorion's Hills, consist mostly of cottonwood, black walnut, butternut, ash, American and red elm,

soft maple, several species of oak, coffee bean, hackberry, basswood, mulberry, &c. The principal under shrubs are cherry, prickly ash, sumach, &c. The cottonwood is found everywhere on the bottoms, and often covers the island to the exclusion of other trees. At Floyd's Bluff the well known and useful bullberry shrub first makes it appearance, and continues from thence to the sources of the Missouri. About thirty miles above Council Bluffs the last Sycamore [*Platanus Occidentalis*] is seen in ascending the river, and from its size marks conspicuously the limits of its growth.

Extending along the river, through the States of Missouri and Iowa, is a prominent series of hills, to which Professor Swallow, of Missouri, has applied the geological term of the "Bluff formation." They are composed of a yellow siliceous marl of considerable fertility, and their deposition is comparatively recent, and is indicated by the fact that numerous land and fresh water shells are found in them, specifically identical with those existing in the same region at the present time. These hills are by far the most finely developed on the left side of the Missouri between Council Bluffs and Floyd's Bluff, and seem to enclose the vast bottom prairie as with a gigantic wall. Many of the hills rise to a height of 150 to 200 feet, and so steep are their sides that vegetation can scarcely sustain itself. An excellent farmer on the Little Sioux has commenced the culture of the vine among these hills, and is confident of success. This formation extends beyond the Big Sioux, though not so prominent to the mouth of Running Water, where it gradually dies out, though traces of it are seen throughout the Upper Missouri country, and may be distinguished readily by producing a richer growth of vegetation.

At the mouth of the Big Sioux is an extensive tract of fine timber, and many anxious eyes are fixed on it ready to seize it, as soon as the Indian claim is extinguished. There are many islands in the river of considerable extent, which must eventually be of much interest to the settlers. They are usually covered with a dense growth of cottonwood, which, in the absence of other kinds of timber, will be of considerable value. The great deficiency of fuel in this country, and the total absence of coal, will render the preservation of the existing forest trees of much importance. Dorion's Hills, on the left side, and the mouth of the Running Water on the right side of the Missouri, near latitude 48°, may be considered the limit of really fertile land in ascending the river. Here several specimens of the forest trees cease to appear, as the black walnut, butternut, red elm, hackberry, soft maple, and some under shrubs, and from thence to the mountains we find along the Missouri, and skirting the tributaries, American elm, ash, box-elder, occasionally a few oaks, and the cottonwood is seldom absent in the bottoms. In many places the red cedar is seen, and in the vicinity of the mountains the highest hills are covered with pines. Along the streams a few shrubs appear, as the *Cornus Sericea*, red willow, the inner bark of which is much used by the Sioux for their *kinnie kinnic*, (*Cornus Stolnifera*,) several species of Salix, one of which grows to a large size, sometimes two feet in diameter; mulberry quite rare, prickly ash, &c.

Dorion's Hills, so called from a Canadian who formerly had a trading

post at that place, are a beautiful series of bluffs approaching the river, and filled with finely wooded ravines and springs of water. From this point the soil of the country begins to look less favorable for agricultural purposes, composed mostly of clays of the Cretaceous system, and highly impregnated with saline substances, which seem to be prejudicial to all kinds of vegetation except chenopodiaceous, which in these clays obtain their rankest growth. The timber becomes very diminutive, forming only a thin belt along the river. Besides a deficiency of forest trees, there is a great want of water, and in the dry season of autumn and winter, in all the small tributaries of the Missouri, the water is either entirely absent, or so impregnated with saline matter as to be unfit for use.

About one hundred and fifty miles below Fort Pierre, the black clay bed of the Cretaceous system commences covering the whole country as with a pall, so dark and gloomy is the aspect. This bed extends along the Missouri to the mouth of Cannon Ball river, and over the region drained by the sub-systems of the Teton, Shyenne, Moreau, and a portion of Grand rivers. Wherever it prevails, the soil, if there be any, is exceedingly sterile, producing very scanty vegetation, and sometimes considerable areas present a bare, blackened appearance, without trace of tree or shrub. In the vicinity of the Great Bend below Fort Pierre, these "arid argillaceous hills" are extremely sterile, being much denuded, and presenting a burnt and blackened appearance, so that they have earned for themselves the appellation of "*Cotes Brulés*" by the Canadian voyageurs. These hills are covered with fragments of selenitic crystals, or gypsum, which glisten in the sun's rays like gems, and from this fact are sometimes called the "Shining Hills." Above the mouth of the Cannon Ball river, the sands and clays of the Tertiary system commence, and the general appearance of the country is much improved; the upland is covered with a fine growth of grass, and more timber is seen along the stream.

About fifty miles below White river, is the first cedar island, a favorite wooding place for steamboats in their ascent of the river. This island is one of three which are destined to be of much interest to the settlers along the Missouri. They have an area of several hundred acres, and are covered with a dense growth, so crowded that the largest trees are not more than two feet in diameter. A large quantity of fine timber might be selected from these islands with advantage to the remainder. They are also the resort of myriads of birds and larger animals, which gather to these places to rear their young undisturbed.

The country in the vicinity of Fort Pierre, and north towards the Black Hills, though mostly sterile or entirely barren, contains some plateaus that are covered with a fine growth of grass. The region through which the main body of the Shyenne passes is sterile in the extreme. It is cut up by temporary streams into ravines and gullies to a frightful extent, and barren black hills, sometimes producing a few stunted cedars, meet the eye on every side. Between the two forks of the Shyenne, and in the vicinity of Bear Butte, a portion of the Black Hills, is quite a large area, which seems to have been levelled by de-

nudation, and greets the eye of the traveller with joy, who has for some time previously seen nothing but the sterile country before mentioned. The streams which flow into the Shyenne at this point have their origin in perpetual springs in the Black Hills, and contain an abundance of fish, and swarms of beaver live along their banks. They are skirted with excellent timber of ash, oak, elm, and box-elder, and the level plains are covered with a fine carpet of grass which, in spring and early summer, is enamelled with myriads of flowers of the richest hues. On the 9th of March, 1855, I ascended Bear Butte, and on the south side, six hundred feet above the level prairie, I found a beautiful plant, (*Anemone Patens*,) just putting forth its blossom. The Indians call it the navel flower, for they say that when it blooms young spring is born. At that time the grass was springing up quite green, and herds of antelopes were quietly reposing upon the sunny sides of streams, like flocks of sheep. This is a portion of the country similar to White river valley, well adapted for grazing purposes, and capable of sustaining a tolerably dense population. The Black Hills which appear in the distance, and derive their name from their dark and gloomy appearance, contain an inexhaustible quantity of the finest timber, mostly pine, which will doubtless remain undisturbed for many years to come. I will, however, propose a plan for obtaining this timber, and render it useful to future settlers, though I do it with some hesitation, lest it may seem visionary. The left fork of the Shyenne passes through the northern portion of the Black Hills, and even there is a considerable stream, from thirty to fifty yards wide. In the spring the river is much swollen, and the current exceedingly rapid, and the timber, if cut and hauled to the banks of the river, might be floated down into the Missouri with considerable safety and ease.

The character of the country along the Missouri, from Fort Union to the mountains, and through the valley of the Yellowstone is similar to that in the region of Fort Pierre, as far as its agricultural resources are concerned. In the bottoms, however, the traders and Indians raise very good vegetables. At Fort Union the traders have met with very good success some seasons, but usually drought or early frosts destroy their labors. Three tribes of Indians on the Missouri are somewhat of an agricultural people. The Minnitares at Fort Berthold raised, in 1854, two thousand bushels of corn and beans, pumpkins in proportion. The Mandans, sixty miles below, one thousand five hundred bushels, and the Aricarees, at Fort Clark, four thousand bushels. The drought and early frost of 1855 nearly destroyed their crops, which, in the month of June, looked quite promising. At Fort Pierre, also, the river bottoms and islands are cultivated with some success, perhaps as much so as many of our Atlantic States.

To present an idea of the country on White river, and the modes of travelling on the prairie, I will give a brief digest of my journal, made on a tour to the Bad Lands, in the spring of 1855. I started from Fort Pierre May 7, with an Indian as guide, one voyageur and a boy, with several horses and two carts, for the purpose of making a collection of mammalian and chelonian fossils in that remarkable cemetery. The weather was warm, and sun shining brightly. Most of the usual spring birds had come, and the ravines and water courses

were green with grass and foliage of trees, and many flowers were in bloom. The first day's travel is usually quite short, not more than six or seven miles. We passed the steep, barren, Argillaceous hills that surround Fort Pierre, and encamped on the Teton or Bad river of the Sioux. We made about six miles, course southeast. The region drained by this river is quite sterile, the soil much impregnated with what is usually called Epsom salts in this country. In the dry portion of the summer and autumn the stream has no running water, and the bed and sides of the banks become incrusted with this salt; at a distance they seem to be covered with snow. The water standing in pools possesses very active purgative qualities. This substance occurs very abundantly throughout the prairie region, and its medical effect is very similar to that of Epsom salts. Sometimes a very large area of many acres is covered with it, several inches in thickness. I do not know that any analysis has been made of it. It is very fine, and when pure, white as snow, and much the consistency of flour.

The following day we pursued the same direction, over a country having much the same sterile appearance, destitute of water, and camped in an immense depression, called by the traders "Big Hole." In it is the bed of a little stream that empties into the Teton river, but at this time it was nearly dry; the water standing in pools and very unpleasant to the taste. Our wood for culinary purposes was small willows, and our horses picked a scanty meal in the moist ravines. All the upland prairie was parched with drought.

The following day, May 9, we pursued nearly the same direction, and through a similar country, destitute of wood and water, the vegetation parched by drought. No game was to be seen but a few antelopes, which were so wild that it was impossible to kill them. About three o'clock we reached the head of Medicine creek, a tributary of the Missouri. Our distance was about fifteen miles. We found here excellent grass for our animals, fine clear water, and an abundance of wood. This stream is fed by springs, contains an abundance of fish and well skirted with timber, and much vegetation grows along its banks. Many species of flowers were in bloom, rendering the contrast quite pleasing.

The following day we continued the same course until we came to the White river valley, and the upland prairie presented the same parched appearance. Approaching White river, the country is somewhat rugged, and the hills that bordered the valley had the usual arid sterile aspect, but we soon passed over into the beautiful valley which was at this time clothed with fresh green grass, from ten to fifteen inches in height and the timber skirting the river was in full foliage. Myriads of flowers enamelled the prairies and honey bees were industriously at work by thousands among the Leguminous blossoms. I was not aware that this little inhabitant of civilization had wandered so far into the western wilds, until he appeared here, and I would infer from the number I saw that they must inhabit some of the numerous dry trees along the river. After striking the river we passed up along the broad level to the forks, and camped in a most delightful place. We were in want of nothing, either for ourselves or animals, and of course all in high spirits. The soil of these bottoms is

very fertile, composed of the calcareous and aluminous marls of the Tertiary basin through which the upper portion of this river flows, and the clays of the Cretaceous system which forms the hills, and is the basis formation throughout the valley.

The following day, May 11, we passed up the valley four or five miles above the forks, for the purpose of fording the river. The left fork is the main stream, and, at this time was much swollen and the current quite rapid. The bottom is so full of quicksands and other impediments that we found it very difficult to discover a crossing place. Finally, after a most diligent search of several hours wading about in the stream, we ventured to make the attempt. We first unloaded everything in our carts and carried it to the opposite side, a distance of one hundred and fifty yards, and then letting our carts down the steep bank with great care, we passed safely over on the other side with no other trouble than the miring of our horses in one or two instances. After landing safely on the other side, we ascended the high hills which border the river, and camped in a beautiful ravine, from which flowed a fine spring, surrounded with an abundance of wood. The whole country here has much the appearance of the limestone region near the mouth of the Platte, and I noticed several species of shrubs that are found no higher up on the Missouri than Council Bluffs. Our distance that day was not more than eight miles. The water of White river is very peculiar, containing a large quantity of calcareous and aluminous matter held in suspension, so that it has much the appearance of milk. When allowed to stand for a short time, or whenever it is found in pools, a thick scum may be seen upon the surface very much of the appearance and consistency of rich cream; removing this, and the thinner portion is of a much lighter color, like milk. It is very astringent to the taste, and its medical effect on the traveller is quite the reverse of the water previously used. This river has been navigated by traders with small Mackinac and bull boats for over one hundred miles from its mouth. We found plenty of antelopes near our camping place. Our Indian killed two fine ones, which formed a most acceptable addition to our larder.

On the following day we passed over a fine rolling upland prairie on the northern slope of the dividing ridge between White river and Running Water. After descending two steep hills which border the river bottoms, the prairie slopes gently towards the south for a distance of fifteen or twenty miles to a high ridge which is visible in the distance and covered with pines. Our course was about due west. On our right the lofty denuded ridges of the "Bad Lands" appear, while scattered all over the valley are patches of white earth, monuments of the Tertiary basin left after denudation. The whole valley gives unmistakeble evidence of having been levelled to its present condition by the action of denudation. The day was quite fine. We camped at night on Bad Land creek, and before reaching it we passed through considerable bad ground, which rendered our travelling quite hazardous. They seemed quite appropriately named. There are many things of the deepest interest in this valley, and as yet it is almost *terra incognita*. All the streams on the right side of White river flow from perpetual springs in the distant ridge, and even in the

dryest season they are full of cool crystal water, their sides fringed with many varieties of water plants, and their valleys clothed with abundant grass and flowers. Contrasted with most of the country on the upper Missouri, the White river valley is a paradise, and the Indians consider it one of the choice spots of earth. Indeed, when supplied with an abundance of meat, they always resort here and spend their time in amusements or in cultivating their numerous gardens which are scattered throughout the valley. The Brulés and Yanktons raise a considerable amount of corn and other vegetables, and with very little attention they get a tolerable crop. The greatest deficiency that will be felt here will be the scarcity of wood for fuel, and, like other portions of the upper Missouri country, no coal need be sought after.

May 13.—We again travelled due west across a fine rolling prairie. We met with large numbers of a peculiar species of cactus just coming into bloom, (*Mammaria nuttalii.*) It is more abundant here than anywhere else on the Upper Missouri. We camped at night on Grass creek—another fine stream, similar to those before mentioned. At our left, in the distance, we could see a tall, naked white butte, called Eagle Nest butte, from the fact that an eagle has built her nest on the summit from time immemorial. Although it rises to the height of one hundred and fifty feet, with nearly perpendicular sides, its stratification is perfectly horizontal, presenting a more conspicuous example of the terrible denuding action which has been felt in the valley. On its summit I found several species of plants in bloom that I observed no where else on the route.

May 14.—We passed several fine streams, all having a uniform appearance, and the whole region approaching more closely the fertile portions of Kansas. We camped at night on a fine stream called "The creek where the Indians plant corn." Our Indian guide spent a day here planting a small patch of corn and potatoes. On our left, as far as we could see, was fine rolling prairie clothed with vegetation, while on our right, the tall naked columns and domes of the "Bad Lands" loom up, assuming most unique and fantastic shapes. Our Indian guide led us along an old buffalo track, a very rugged road, a fact of which we were convinced by having our carts upset and the contents distributed over the ground. The Indians say, however, that in travelling over a country with which they are unacquainted they always follow a buffalo trail, for this animal always selects the most practicable route for his road. At the mouth of this creek is the most beautiful exhibition of the Bad Lands I have ever seen.

On the 18th we camped near a fine spring, which was but a little distance from it, and we resolved to stop a day or two and explore it. Our animals needed rest, and here was an abundance of good grass and water. After partaking of a delicious dinner of antelope meat, I started out, accompanied by my voyageur, and ascending an elevation which was above the bad ground, looked down upon one of the grandest views I ever beheld. The denuded area was nearly square in form, and the immense flat concretions that projected out from the sides of the perpendicular walls in regular seams, and at about equal distances above each other, resembled some vast theatre; indeed, it reminded

me of what I had imagined of the amphitheatre of Rome, only nature works upon a far grander scale than man. We climbed with great difficulty down the steep sides, following the main channel of the little stream, and after much winding through this labyrinthian sepulchre, we came to an open plateau covered with fine grass, and in the centre a beautiful grove of cedars, and through the whole a stream of milky water wound its way to White river, about five miles distant. All around us were bare, naked, whitened walls, with now and then a conical pyramid standing alone. We felt very much as though we were in a sepulchre, and, indeed, we were in a cemetery of a pre-Adamite age, for all around us at the base of these walls and pyramids were heads and tails, and fragments of the same, of species of which are not known to exist at the present day. We spent that day and the following exploring the cemetery, which the denuding power of water had laid open for our inspection, and many fine specimens rewarded our labors.

On the morning of the 21st, we started for White river, on which we camped. We were about to leave behind us good grass and water, for in the direction we were going we could expect nothing but a desert and salt water. The bottoms were, as usual, quite good, but the hills that bordered it were terribly denuded, showing us that we were still in "Bad Lands." The following morning we crossed the river with some difficulty, on account of the sinking of the horses into the quick sands, and then wound our way among the sand hills in a direction nearly parallel with the river. These sand hills sustain very little vegetation, have often very nearly perpendicular sides without stratification, and are probably formed by the mud. On our right, the main body of the Bad Lands appeared with its numerous labyrinthic passages, illustrating most finely the denuding power of the water. Many rare plants were observed here, but few animals. One species of lizard was quite common, but very agile in its movements. We succeeded, after many attempts, in catching one of them, by throwing a blanket over it suddenly. Antelopes were more abundant than other kinds of game, and we were able to supply ourselves with meat. Occasionally a big horn was added, which made a very agreeable variety. The meat of the female has much the flavor of mutton. On the following night, we camped on a tributary of White river; wood was very scarce, and the water of the poorest quality. All the tributaries of the northern side of White river are of the same character. The next day we were desirous of getting to Bear creek, the usual camping place of visitors to the Bad Lands. Our road was exceedingly rugged, winding among the terrible cañons and gullies. We were not able to get through without again upsetting our carts, and were obliged to pack our baggage a considerable distance. At last we struck the main road between Fort Pierre and Fort Laramie, and then our troubles were at an end. We had followed an old buffalo trail seventy-five miles through a country never before travelled by carts. We had been seventeen days reaching Bear creek, whereas, if we had followed the usual route, it would have required but six days. But I had the pleasure of exploring a large area of most interesting country, never traversed before but by Indians. The locality at Bear creek has yielded

the large and valuable collections which have already been brought to the States by Mr. A. Culbertson, Captain Van Vliet, Dr. Evans, and others, and furnished the material for the magnificent work of Professor Leidy, "The Ancient Fauna of Nebraska," published by the Smithsonian Institution. We spent five days at this locality, and with the mammalian remains already collected in other places, our carts were loaded to their utmost. I noticed one peculiarity in the atmosphere at this place—the frequent showers that annoyed us very much, for they kept the marly earth around us in a disagreeable condition. In passing out of the Bad Lands our carts were much impeded by the mud, but when we ascended upon the plateau above, the storms ceased, and thirty miles east of that point we could see no indications of its having rained for several weeks. From Bear creek we made an ascent of two hundred feet to a broad plateau, extending, with little interruption, to the head of Teton river, a distance of about fifty miles. The formation upon which this plateau rests is a yellow arenaceous bed, much more fertile than the black clay bed in the region of Fort Pierre. It is covered with a good growth of grass, and affords a fine pasture ground for numerous herds of antelopes.

On the night of the 30th, we camped at Sage creek, so noted among voyageurs and travellers, for the purgative qualities of its water. I stopped here several days in the summer of 1853, with my friend, F. B. Meek, esquire, and both ourselves and horses experienced its weakening effect. This creek rises in the Bad Lands, and taking a northeast course, empties into the Shyenne. It is somewhat noted for the abundance of fine Cretaceous fossils that are found along its banks. For about four miles east of Sage creek the road is very rugged, until we again ascend to the table land. Twelve miles distant is Bull creek, also a tributary of the Shyenne, and takes its rise in the Bad Lands.

The dividing ridge between the Shyenne and White rivers, forms the most elevated portion of the Bad Lands. Fifteen miles east of Bull's creek, is Pinon's spring, a noted camping place among voyageurs, as being one of the very few good springs of water on the road between Fort Pierre and Fort Laramie. It is the head of the Teton river, and is so called in the Sioux language. It runs in an opposite direction to the creek before mentioned, for about four miles, then passing through the eastern portion of the Bad Lands, becomes the Teton, takes a due east course, and empties into the Missouri four miles below Fort Pierre. Near this spring is an elevated ridge composed of white aluminous and calcareous marl, containing slabs and concretions fully charged with fossil shells of the genera *Lymnea*, *Planorbis*, *Physa Helix*, &c., also seeds of *Chara* and fish remains. Some of the shells have already been described by Drs. Evans and Shumard. It is a curious fact, that though these shells are of extinct species, living shells of the same genera, and plants of living Chara, are now existing in the stream that runs at the base of the ridge. The remainder of our route we crossed the heads of the other tributaries of the same stream, with very little wood and poor water, and at this time the earth was so parched that very little good grass could be obtained for our animals. On June 6 we arrived at Fort Pierre safely, having been absent thirty days.

Respecting the climate and geographical distribution of plants, much might be said in this connexion. There is in this country a wet and a dry season. The wet season usually commences about the middle of March, and continues until the middle of May. The rains during this time are frequent and severe. It has been known to rain thirty days in succession. The dry season commences about the middle of July, and usually continues through the autumn, and sometimes a portion of the winter. Perhaps three-fourths of the plants of the country are in blossom during the months of May and June, or the first half of July. During the month of September the ground becomes parched by drought, and very little vegetation clothes the prairies, and everything has the aspect of desolation. Very few flowers are in bloom, except now and then a composite plant. The principal portion of the flora of the upper Missouri belongs to the great families of *Cruciferæ*, *Leguminosæ*, *Compositæ*, *Chenopodiaceæ*, and *Gramineæ*. Of Cryptogamic plants there is a great dearth. I found but two species of Ferns above Council Bluffs; very few Mosses, Lichens and Fungi. Throughout the limestone region of the State of Missouri, we have the sugar maple [*Acer Sacharinum*] in great abundance, also many species of oaks and hickory. These cease in latitude 42½°. At the mouth of Big Sioux we find *Fraxinus Americana*, *Fraxinus quadrangulata*, *Tilia Americana*, quite abundunt. *Gymnocladus Canadensis*, sixty feet in height. *Populus Canadensis*, the most abundant tree in upper Missouri. *Ulmus fulva*, common, associated with *Juglans nigra*, *Juglans cinerea*, *Celtis occidentalis*, *Gleditschia tricanthos*, *Acer rubrum*, from which the Indians formerly made sugar on the Big Sioux and Vermilion rivers, two or three species of oaks, &c. Among the under shrubs may be mentioned the bullberry, *Shepherdia argentea*, which commences its growth at this point. Also, along the borders of streams, *Zanthoxylum Americanum*, *Staphylia trifoliata*, *Euonymus atropurpureus*, *Symphoricarpus vulgaris*, the most common shrub throughout the upper Missouri country, often covering the lowland prairie for many miles in extent. *Cornus sericea*, and *Stolonifera*. *Vitis*, *Ribes*, and *Rosa*, several species of each; *Rhus*, and *Salix*, a number of species. At the mouth of Running Water, latitude 42° 50′, many of these trees and shrubs cease, and we have from thence to the mountains very few forest trees, the ubiquitous cottonwood, *Ulmus Americana*, a species of *Fraxinus*, *Negundo aceroides*, and frequently, though not so common, *Quercus Macrocarpa*, with one or two other species of oak. Two species of *Juniperus* are quite common, one on the bottom, and the other on the arid hills. A trailing species commences in the Tertiary beds, near Fort Clark, and often covers the arid hills in that formation as with a carpet. I saw it in one locality in White river valley, on the top of Eagle Nest butte. On the high ridges of the Running Water, White river, Black Hills, on the Yellowstone, and on the Missouri, above Fort Union, a species of pine is quite abundant—*Pinus brachyptera*. In the Bad Lands of the Judith, a second species of that family occurs, and it is the only locality where I have seen it—*Abies Douglassii*. About fifty miles below Fort Pierre, a remarkable saline shrub first makes its appearance—*Sarcobetus Vermicularis*—first discovered by Prince Maximilian, in his tour up this country in 1832. It belongs to the family *Chenopodiaceæ*, and finds its

maximum growth in the sterile, saline clays of the Cretaceous beds. It is rare at this locality, also on the Shyenne not abundant; but above Fort Union, near the Muscle-shell, it covers the bottoms, to the exclusion of the well known *Artemisia*, and *Linosyris*. On the Yellowstone, particularly in the vicinity of Tongue river, it covers the lowland prairies, and is used as fuel by the Indians and traders, and called by them grease wood. It grows to the height of six or eight feet, and sometimes two or three inches in diameter. I observed the *Eleagnus Argentea* in but one locality, on the high hills above Fort Clark. Of the edible roots we find the most important one to be *Psoralea esculenta*, the *pomme blande* of the voyageur. It is found very abundantly throughout the Sioux country, commencing at Dorion's Hills, though not common in the Yellowstone valley, or upper Missouri above Fort Union. It forms the most useful article of food to the Indian, among the spontaneous products of the country.

The lower tribes of the Sioux, who have but little game, subsist almost entirely on it for several months of the year. It is eaten raw or boiled, or dried and pounded fine, and then made into a kind of pudding or cake, and is quite farinaceous. The groundnut, or *Apios tuberosa*, is very useful to the Indian. It grows very abundantly along the river bottoms, and is gathered in large quantities by a kind of wood-mouse for his winter store. The squaws make a business, during the months of October and November, of robbing these little animals, and I have often seen several bushels of the tubers in a single lodge. They are boiled with dried buffalo meat, and make a rich and palatable dish. The Indians also make use of the root of a species of *Helianthus* to some extent, which resembles an artichoke. It grows along sandy borders of streams, and is procured during February and March. There are some excellent fruits indigenous to the country. *Cerasus Virginiana* grows in great abundance in many places, and the fruit is gathered in large quantities and dried. Above Fort Union, and on the Yellowstone, it grows in large thickets, and these are the favorite resort of the grizzly bear during fruit time. By far the most delicious fruit is the service berry, *Amelanchier*, which is also quite abundant, and ripens in June. The bullberry is the most abundant, but is very acid until after the autumn frosts, when it becomes quite palatable. Plums, also, are abundant. A far less delicious fruit than any of the others before mentioned, but one which is oftentimes of much importance to the hungry voyageur or Indian is the rosebud, as it is called, that is the fruit of a species of *Rosa* that remains on the bush during most of the winter, and often preserves the life of the foodless traveller. I have known many instances of men travelling from four to six days with no other subsistence than this fruit which they gathered on the route.

Of the various kinds of animals and their distribution, I might here say a few words. Many of them are fast passing away, and in a few years those upon which the Indian is now dependent will become extinct. The buffalo, which have been so important an agent in the preservation of the Indian, are now gradually gathering into a smaller area, and although in the valley of the Yellowstone, and along the upper Missouri, thousands may yet be seen, they are annually decreasing at a very rapid rate.

In 1850, buffalo were seen as low down on the Missouri as Vermilion river, and in 1854, a few were killed near Fort Pierre, but at the present time none, unless it be a stray bull, are seen below Fort Clark. Even at the base of the Black Hills it would be difficult for a party of white men to support themselves by hunting. Probably at this time game, such as buffalo, antelope, elk, big horn and beaver, are more abundant in the Yellowstone valley than in any other portion of the upper Missouri. In descending the Yellowstone river in 1854 for a distance of 350 miles, I do not think there was a moment in which I could not see game in great numbers. In the vicinity of Floyd's bluff, and from thence to Running Water, the red deer (*Cervus Virginianus*) is quite abundant, and the Santees from the Mississippi, and the Yanktons, who spend the summer near Fort Pierre, resort here during the fall and winter to hunt them. A few elk are seen, but not abundant. Wild turkeys are very abundant in this region, but usually keep near the boundaries of civilization. A few have been seen at the mouth of White river and in the valley. In the vicinity of the frontier myriads of prairie fowl are seen; the common species of our western States, (*Tetrao Cupido.*) It is extremely abundant from Council bluffs to Floyd's bluff, and a few are seen at the mouth of the Vermilion, and possibly as high up the Missouri as Dorion's hill. Here another closely allied species, *Tetrao phasianellus*, takes the place of the *Tetrao cupido*, and is quite abundant from thence to the mountains. The quail [*Ortyx Virginiana*] has not been seen above the mouth of Running Water. The most northern limit of the *Sciurus magnicandatus*, or fox squirrel, is the mouth of Running Water. It is quite abundant at Floyd's bluff. The raccoon (*Procyon lotor*) has not yet passed far beyond the frontier. A few have been seen in the White river valley. In descending the Missouri in the fall of 1854, I killed one on the shore of the river, forty miles above the mouth of Running Water. They are quite abundant about Floyd's bluff, and their skins are a considerable article of trade with the lower tribes of Indians. The black tailed deer (*Cervus macrotis*) is seldom seen below Fort Pierre. It is found chiefly in the ravines and in the most rugged portions in the vicinity of the Black Hills and the mountains. The interminable ravines of the Shyenne and Sage creek are noted places for them. The antelope is also seldom seen below Fort Pierre. It is, however, the most abundant animal in the Sioux country, and confined to the open prairies. Elk are still abundant in the region of the mountains. Large herds of them are seen in the valley of the Yellowstone and along the Missouri above Fort Union. Below these points they are seldom seen in herds. The big horn (*Ovis montana*) is quite abundant in the almost inaccessible regions known as the "*Mauvaises Terres*" or Bad Lands, but are not hunted much by the Indians for food. The beaver is increasing very rapidly and many of the mountain streams literally swarm with them. Since the days of the trapper are over, and the price of the fur has become so reduced, the inducements to hunt them are not very great, and they are allowed to multiply undisturbed. Their flesh is eaten to some extent by the Indians, and in the absence of other meat is considered quite a delicacy. There appears to be no diminution in the wolves and foxes, and as they are of little economical value, I will not speak of them in detail.

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[The asterisk (*) denotes special reference.]

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ERRATA.

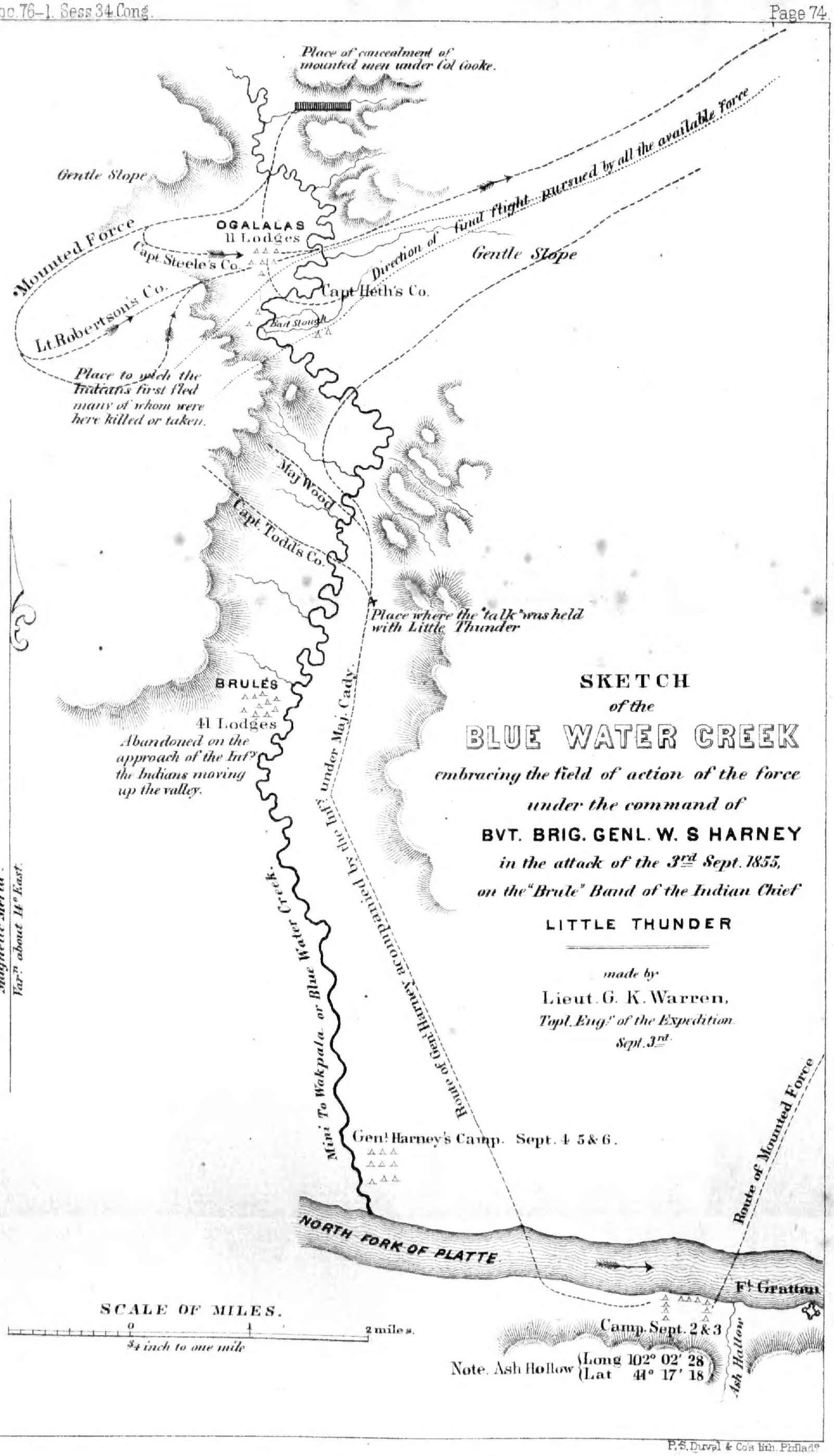
For "scale of 1 to 300,000," read "scale of 1 to 3,000,000," 22d line from bottom, page 20; same in letter to Colonel Abert, preceding the report, and in the table of contents.
For "Itazipchois," read "Itazipchos," pages 3 and 16.
For "Washté Wahpa," read "Wakpa Washté," 20th line from bottom, page 12.
For "James Boldeaux," read "James Bordeaux," 10th line from bottom, page 20.
For "Alexander Cubertstone," read "Alexander Culbertson," 8th line from bottom, page 20.
After "Chenopodiaceous," read "plants," 4th line from top, page 70.
For "tails," read "turtles," 12th line from top, page 75.
After "species," omit "of," 12th line from top, page 75.
For "mud," read "wind," 25th line from bottom, page 75.
For "pomme blande," read "pomme blanche," 11th line from top, page 78.

Table 6, *page* 60.

July 17, 3 p. m., for "354," read "254."
July 17, 4 p. m., for "160," read "237."
July 19, 2 a. m , for "534," read "634."
July 20, 10 a. m., for "750," read "716."
July 21, 6 p. m., for "484," read "384."
July 21, 7 p. m., for "482," read "382."
July 22, 3 p. m., for "491," read "391."
Disregard the means at the bottom of the table.

Table 7, *page* 61.

July 17, 1 p. m , for "475," read "311."
July 19, 6 p. m., for "772," read "672."
July 20, 6 a. m., for "626," read "726."
Disregard the means at the bottom of the table.
Table 9, page 62, makes the amplitude of the daily curve about $\frac{1}{100}$ of an inch greater than the observations in table 6 call for.



SKETCH

of the

BLUE WATER CREEK

embracing the field of action of the force under the command of

BVT. BRIG. GENL. W. S HARNEY

in the attack of the 3rd Sept. 1855, on the "Brule" Band of the Indian Chief

LITTLE THUNDER

made by

Lieut. G. K. Warren,

Topl. Engr of the Expedition

Sept. 3rd.

P.S. Duval & Co's lith. Phila.a

Section of Map

COMPILED IN P.R.R.OFFICE

with additions designed to illustrate

Lt WARREN'S REPORT of MILITARY RECONNAISSANCES

in the Dacota Country

1855

Scale of 1:3000000

Compiled by Lt Warren, T.E.

Drawn by E.Freyshold.