1873

B.N.H.B.C

III

Private Diary

G M Dawson

H.M.B.N.A.B.C.
Sept. 1873.

Expedition Westward along the 49th parallel from Dufferin

Sept 3. 73. Directions for water &c from Huckhuer, the last in from the stations.

Near the "Timber Island" go South of two large fields, find house & good well with water.

Camp at "Grants". where well & water.

Two miles further water in coulé.
Some water at Pembina Depot (now broken up)

Going N.W ward. At Iron mountain water in creek.
A rusty "iron stone" on the left of the road on the W side of the hill.
Coulé 3 miles W of iron mountain, water.
Calf mountain. Water & Wood to South of road.
Camp at Pembina R.
No water or wood from Pembina R to a Coulé 3 miles this side Long R. There wood but no water, Both at Long R. 24 miles from Pembina R to Long R.
No certainty of water from Long R to Badger creek 20 m. & no wood.
After passing Badger Creek take N road. No wood from there to Turtle mountain. plenty water.

Got everything ready for start, Carts loaded &
Waited a while for the mail. Got it sorted
& left by 10 A.M. The morning dull & misty.
Road muddy. Party consists of Self, Duckworth,
Spearman, Paul (teamster) Two Red R Carts
& my one mare.
After passing the Marais R timber the prairie
to the N absolutely treeless, with the exception of
one "island of timber" about 16 m from River.
The prairie not absolutely level but with perceptible
undulations of a foot or two in depth, forming
swales with a general direction a few degrees
W of N.
The Pembina R heavily timbered all along, as far
as followed today. Timber mostly oak. A good
many settlers here & there along the river, their
fields showing splendid crops of wheat, potatoes &c.
Prairie dry & stretching away to horizon, covered
with flowers, several wild-asters. Gold-weed,
branching sunflower (see specimens from Dufferin)
In somewhat low grass or where little brush
of Snow-berry find the gentian.
Many prairie chickens.
Stopped for dinner about 3 P.M. at a
farmer's called Stiers. Good water in
his well which about 15 deep. Water near
7 feet with a slight flavour of SH_2. Temp 42°.
Told that plenty water in the well all the year
round. Pembina R here (say 16 m. W of R.R.)
a stream of 20 to 30 feet wide but deep, winding,
water of a bluish-white from suspended matter
& banks steep & muddy.
Timber along the R beautiful under the warm

Sun full of deep cobalt-gray shadows seen between the upright stems of beautiful oaks.
Just after leaving dinner stop the long perfectly level, blue edge of Pembina hut, or Escarpment, appeared bounding the horizon. Had a most remarkable effect, & caused the level prairie over which travelling took like the lake it once was.

At Grants another well Temp of water 39°.

Told that good well at Amours about 17 ln out with water like Etiers, & well about same depth.

Saw many old rotten Buffalo bones in a coulé where also were bleached lumnea shells & other indications of an old pond in which the large animals died no doubt during their migrations

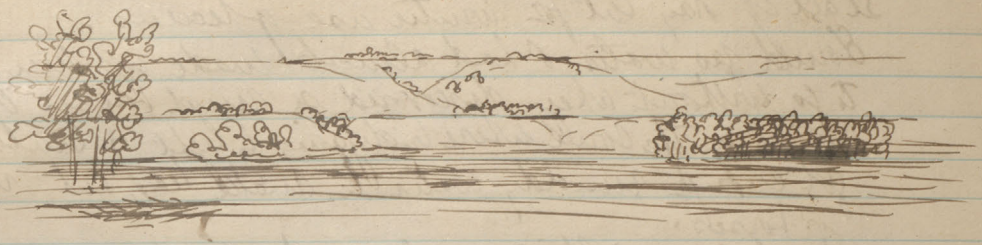
Met a "Whitewater waggon" that unbreakable institution with 3 or 4 men in it. Asked where from & found that had been out trying to kill Buffalo near Devils Lake, but without luck. Indians all gone.

"Grants" a Store & tavern, & I suppose something in the farm way too. A large & well built white painted house, quite a surprise in so new a country.

Thursday Sept 4 73. Just as leaving Camp Paul's horse broke its collar unexpectedly. Fortunately got another from Grant for $2.00 & so not much delay. Got off by 9.
Struck N.W. to line & from thence followed due west from one post to another. Beautiful prairie all the way to Pembina but with very little of a damp character (as now indicated only by the difference of herbage) & that covered with good hay grass.
Got about 2 P.M. to a Coulé where from appearances like a few willows &c thought to find water. None however. Had fortunately brought on enough from Grants to make tea. Horses did pretty well on the grass wet with rain.
Had intended to start close up along the edge of mountain for Geological purposes. Saw however that no expedies, & also found that coulés ran across in such a manner as to make it necessary to keep well up foot of slope.
Shortly after leaving dinner stop found a Coulé with bullrushes & a muddy stagnant pond in their midst, where bones of cattle lying round showed where animals had mired in crossing or coming down to drink. Got enough water for horses but so bad that one of them refused to drink.
Got to Pembina depot just at dark & pretty well tired out. The depot is now abandoned & there remains only a log shanty & a great

Stack of hay cut for winter use of teams.
Found no water & had almost made up minds to go without when discovered a mud hole in the bottom of the coulee where by digging by light of lantern got enough muddy water to make tea, but none for horses.
All day very cold & regular autumn storm from N.W. with blasts of rain every few minutes.

The prairie from Grants & Pembina hill beautiful & apparently excellent good soil but no timber whatever & no water apparent on surface.
The slope of the Turtle escarpment is mostly timbered & beautiful points & islands of oak timber lie out from it & along its base.
The prairie grass which from a distance looks quite lawn like running up round the beautiful & symmetrical woods gives quite park like appearance.
Prairie to East boundless to the eye & absolutely treeless.
The low level prairie seems to slope up a little toward the escarpment, & begins to show a few boulders & stones toward the E. edge of the valley.
The escarpment itself rises in two steps, the first being a little less than ½ the height of the second & standing out shelf like from its front.
Both perfectly level on tops with exception coulees &c.
On the top of lower terrace where Depot situated many Pembinian boulders cropping up here & there.



Sept. 5. Friday. Left Pembina Int Depot & followed the Commission Trail N.W. ward. It ascends the first terrace level where the Escarpment generally forms a point & where the lower part of the fall is diffuse & undefined. The trail then turns into a coulé which is pretty heavily timbered (oak) & in which there are pools of water; & by it reaches the higher prairie level. The summit of the first terrace appears gentle & undulatio slightly, the undulations forming well defined NNW swales.

As seen from the ridge the prairie has some large islands of timber to the N.E. & a line near the horizon which probably indicates the Scratching R.

The edge of Pembina Escarpment is in many places cut up by numerous & winding coulés the banks of which form bold & very steep grassy hills of very considerable vertical amount.

To the west of the road just here a bold bare bluff front of crumbling cretaceous clay (see field notes) also many boulders & one large & conspicuous covered with red lichens

has caused the place to be called the Cow Mountain.
Stopped for dinner at a pool of water in a coulé, in which I shot a couple of ducks & Duckworth a bittern.
Just after starting got one of the carts mired in crossing the coulé, & the traces broken, Duckworth shooting off the front of the cart as if from a catapult. Not much delay however.
Passed over a great prairie but not so level as that at the lower level, having been much longer exposed to denuding influences, & having as a consequence assumed an undulating character. Little wood to be seen, though a few distant groves.
Soon came in sight of Calf Mountain which looked like a little hemispherical hill when first seen & took us a long time to overhaul.
Its importance diminishes as approached, & it finally turned out to be an elevation perhaps 30' above the general level, & forming an outlying knoll of a well defined ridge with a N.S. (mag) direction.
A very extensive view from the "mountain" however. The prairie N.W. - W - & S.S.W. with many small clumps of low bushes, but little timber, surface undulating & damp in the lower hollows which bear luxuriant hay grass.
Onward from Calf but till overtaken by night at one of the hay cutting stations on the side of a gently sloping coulé. Not knowing how far to Pembina R, decided to camp. While

tents being pitched Spearman went down to look for water & after poking about for some time came back to report that it was "The d—est prog-pond I ever see". Got some water at last which though not looking inviting did not give the tea a taste.
The stock during the whole days march has had an excellent appearance, with the exception of a strip near the edge of the Escarpment where probably the Cretaceous clays are but thinly covered, & the grass is thin & dry.
No difficulty would be met with in getting water in any part of this prairie by digging shallow wells in the lower hollows.
A boisterous night, rain & wind, & very cold.

Saturday Sept 6 73. Morning wet in showers with strong cold wind.
Got up & came a few miles to the W. Bank of Pembina R. where camped.
Afternoon visited & examined a Cretaceous exposure about a mile S.

Sept 7. 73 Got away pretty early.
Walked ahead & took sketch of Pembina R valley. as the morning fog lifting. The night had been very cold with heavy hoar frost & thin skim of ice on water in kettle.
Travelled on over a boundless & undulating prairie without a stick of timber, & few

& small bushes. Thickets here & there of dwarfish snowberry, spirea, now & then a willow, & many small rose bushes. Now & then a thicket of metallic looking Shepserdia
Stopped for dinner which cooked with wood & water brought from Pembina R.
Saw a few large heron, cranes but could not shoot them. A good many red underwing grasshoppers about, & many black crickets chirping in the dry grass.
Found a swamp with water enough for horses shortly after dinner.
Saw a cretaceous section in Coulé 3 miles E of Long R.
Long R in a valley like that of Pembina R but not so deep & on smaller scale altogether.
Found 2 men camped where the depot was waiting to forward mails two & fro.
Took hammer & examined section about ½ mile N of Camp.

The prairie passed over today is generally fertile, though in some places probably not equal to the best. (See sample of soil).
Its undulations are on a larger scale than those of Tayen E of Pembina R.
There is little water but probably good wells might be made in the deeper swales, & coulés which now (though generally dry) bear swamp grass.
No timber to be seen till that of Long R comes in sight.

The permanence of trails on the prairie is wonderful. A cart track once well formed in the deep soft prairie sod seems to last, (though seldom or never used afterwards), almost for ever.
Frog R. a very small stream but with good water, & some large pools.

Sept 8. Up by 5.30 & while breakfast cooking examined a bank on the other side of the river.
Travelled by the somewhat winding trail to Badger Creek. The prairie though preserving its general uniformity of level is here broken up into rolling hills with valleys between with high good grass. The hills themselves generally with thin grass & often too steeply undulating for easy tillage.
Badger Creek a beautiful coulé with pretty woods & bush & quite large ponds of water connected by a rill. Quite an oasis in this grassy desert. Shot a tortoise sunning himself on a rock, there appear to be many of these animals in the pools. Took in a supply of wood & travelled about 8 miles to a salt lake. The water beautifully clear looking & inviting looking at a distance but when approached the stones lying round

are seen to be covered with a whitish saline crust. The lake very shallow at the edges & with a border of treacherous grey mud. Many water birds. Cranes, ducks, plover &c. Found some limpeas on the shore & great numbers of a small planorbis looking shell (See specimens) Also found Salicornea &c growing luxuriantly.

About a mile further came to coulé with good water & camped.

The road today rather hard on the horses being dry, hilly & stony.

The prairie, or rather hilly country passed from Badger creek to this place of same character as that E of the farmer place.

Probably no water difficulty in country passed over today, as proper wells in low swales.

No wood whatever, not even bushes save dwarf roses &c & small willow withes round the low hatches.

Passed many bones of Bison, these remains are rapidly becoming more & more numerous & in better preservation. One skull found today so good that had it put on one of the carts.

Saw few prairie chicken today, but many cranes which were exceedingly shy. Their peculiar cry heard for long distances.

Tue. Sept 9. 73. Morning very fine.
Passed over hilly country like that of yesterday & resembling downs. Many large boulders especially along the sides of the coulés. Passed two small lakes to the Right fringed with extensive reed beds & teeming with duck. Saw some large white cranes but could not get within rifle shot of them.
Fourth Mountain came in full sight shortly before noon, showing as a dark blue looking elevated area, flat topped with the exception of one or two conical peaks or buttes. The whole "mountain" appears to be wooded thickly with oak & poplar. Told that many little lakes & some large swamps on the mountain. Many Sioux indians about it 20 or 30 came down to Depot the other day & had to be propitiated with biscuit &c.
Several oxen have also disappeared mysteriously probably serving instead of buffalo to the indian.
On arriving at depot found that all officers had "gone West" the last party having left on Sunday. only depot man (Ellis) some bayonetters & teamsters left.

Saw today very many deeply worn ruts in the prairie sod crossing the road

Thought at first that Cart tracks but soon found that could not be, but really old buffalo paths & probably indicating pretty well the direction of their migrations. The ruts were nearly parallel, generally ran along the low ground & all tended to the N.W.

Wednesday Sept 10. Got carts & harness put in repair, & stores replenished. Decided to leave Duckworth at the depot to shoot & skin & collect whatever he can. Thinking this better than to keep him travelling on the chance of reaching a better place & doing nothing meanwhile.
Got off by 2 P.M. intending to go 6 miles to the first water & camp there to reduce tomorrows journey to about 18 miles that the horses may start fresh for the 25 mile journey without wood & water which is the stage 2 of the Souris R.
Whittaker thinking it best to report to Capt

Anderson started with me. I being glad of his company & the accession of his rifle to my now small party. Just before reaching Camp, met Ashe King, Millman & Pratt on their return to Turtle Depot, having received letters from Capt Anderson which turned them from their westward course to complete the Turtle Nut line. Stopped a few minutes & gave them their portion of the mail.
Camped by the small lake 6 miles W of Depot. Shortly after the horse train passed on their way in to Dufferin. Whittaker returned with them as he received orders to go to a new subsidiary depot on Turtle Nut.
Country passed over today still rolling muck with wide valleys & sharper hills. Stretches away open to the Fairy on Northward. Southward we skirt the edge of turtle nut woods not far off.
The lake here occupies a rudy pool & the water slightly saline to taste & very hard.
Weather today hot as midsummer.

Thursday Sept 11. Morning very cold with scotch mist & fog. Left Camp pretty early. Road continues to run not far from the edge of Turtle Mt & pretty nearly parallel with its general direction. The soil of country passed over is not of the very best character being thinner & often sparsely. Always however covered with a close sod of thin grass, now nearly dry. Many coulés & creeks run from base of Turtle Mt toward White Water Lake. Some water in pools in many of them yet & from the muddy nature of their bottoms they must be nearly impossible to cross in spring. This section of country will probable be used only as pasture land till all the best arable land has been taken up.

Shortly after noon met an indian with his gun slung over his shoulder & hanging in a leather case cross wise behind him. Enveloped from head to foot in a long white blanket, he looked quite spectral when first seen coming over the brow of a hill against the foggy sky. Could not speak English but signed that were indians near. Soon after saw 8 or 9 indians walking toward the trail from a couple of tepis pitched about ½ mile south of it. One of them who could speak english asked questions about where going &c

& as to other parties. He walked some distance & then asked for something. Gave him a plug of tobacco. Soon after saw an indian on horseback riding fast after us. Found that he had come to trade a pair of moccasins for "Tea" "Sugar", these appearing to be the only words of english he knew. Did not want the moccasins but gave him a handful each of the coveted luxuries. He wore a fine new pair of deer-skin trousers, good cloth coat, & over all a blanket. These Indians as they told us Sioux or Dakotas. "English Sioux".
Tall well built men & perfectly straight. Faces not unpleasing & quite light coloured. Splendid men compared with the Chippeways.

Camped a few miles past the indians at creek where told last wood & water for over 20 miles. Would have gone further if possible to make sure that indians would give no trouble.
Afternoon reading &c.
Got fodder cut & horses tied up to carts in front of tents, in case the Sioux should take a fancy to them.

Two mounted scouts passed toward Turtle Depot with letters just as leaving Camp this morning.

Friday Sept 12. 73 Made a pretty early start. Morning overcast with cold cutting wind. During the day two or three slight showers, one of sleet.

Stopped for dinner after having come about 14 miles.

The prairie rapidly loses its abruptly undulating character on leaving the vicinity of Turtle Mt. First becomes gently undulating & toward the Souris R. nearly flat.

The hills & edges of hollows are thickly strewn with boulders most of which Laurentian & some limestone. The badger holes everywhere show a whitish gravelly subsoil, with much fine limestone gravel. Many small circular or rounded depressed areas lying between the undulations. These, in spring, must be ponds but are now dry, but well marked by growth of long green grass (in some places as high as the horses backs) & contrasting strongly with the thin & now dry grass of the prairie generally. In some cases, a large boulder formed the nucleus of the smaller pond-hollows.

The vegetable soil not deep, where a sample taken at dinner time only 6 or 8 inches. It is besides somewhat light & sandy, & the prairie generally has the appearance of a somewhat worn out pasture. The soil would probably require manure after a few years.

A few miles E of the Souris crossed a

wide & well marked depression of over 50' in depth. Running N & S & appearing like an old bed of the Souris. Found a small lake here, with some geese on it. Took a flying shot but with no luck.

Met one indian today who gave me to understand, by signs, that he was going to hunt at Turtle Mt. Asked for powder &c. Had none for him but gave him a plug of tobacco.

Found cacti growing on the prairie a few miles W of Turtle Mt. Quite low, & appearing to be about the only vegetation which has withstood the prairie fire, which has swept miles of todays journey within a week or two. (Opuntia?)

Vegetation here in advance of that at Dufferin & Lumbria Mt. Liatris & other flowers there still showing bloom here entirely gone to seed. Probably as much on account of the lightness of soil as anything.

No wood or water today for over 20 miles. Got in to Souris depot at dusk. Found merely a tent pitched & stores covered with tarpaulins, which speaks well for the honesty & good temper of the indians of whom a lot camp have been for some days near the depot.

Saturday Sept 13. Did not manage to get supplies at Depot & get up till 8.45. Ascended the side of the Souris Valley, which is nearly 100 ft high, steeply sloping & bounds a flat depressed area about 3/4 mile wide through which river meanders.
Followed the commission trail which leaves the S. Antler Creek, & strikes W to the N Antler, which it follows to a point about 13 miles from the Depot. Here it strikes S.W. to return to the S. Antler which it crosses & follows for about 5 m. on the S. side.
Saw 3 antelopes today. One on the N Antler & two more where the trail first strikes the S. Antler. In both cases they were beyond rifle range before observed. They continued to increase their distance stopping very few seconds to look back.
Prairie passed over today undulating, the undulations generally have their greatest extension E & W. The soil rather thin & gravelly but everywhere covered with a strong sod. The grass now nearly dry except in hollows where quite green still. The only shrub seen Shepardia forming thickets scarcely 2 feet high.
The N Antler Creek a wide shallow valley with a winding brook coursing from side to side & now nearly reduced to a chain of pools. Banks generally sloping & where steep & bare showing only rolled gravel & sand.
The same words will describe the S. Antler Creek

which only differs in being partially wooded.
Many buffalo bones & all the lateral valleys & gulleys of the creeks scored with buffalo paths. Also a great number of little sand rolling holes forming shallow oval depressions 12 to 15 feet in length.
No water along road from N to S Antelope Creek.

Sunday Sept 14. Made a pretty good start taking wood & water for 20 miles. Stopped after about 13 m. for dinner. Shortly three Red R Carts & several men appeared. Learned that they belonged to Capt Cameron's party & were some hours in advance of him. Rode on in advance for about 7 miles & found Capt C. still at the W. Souris Depôt, which he did not leave till about 4 o'clock & just as my carts with the mail arrived.
Collected a few shells in the River.
Evening a scout going E passed through on his way to overtake Cameron's party. Wrote home by him.
Arranged to start tomorrow at noon & take parts of 3 days to Wood End. Gave mail by Lubis to forward by scout tomorrow morning.

The prairie passed over today gently undulating. Soil dry & sandy with much gravel & boulders in places but everywhere covered with sod, though now of a whitish yellow colour & quite dry except in hollows.

Valley of the Souris wide & deep with steep rounded green hill banks at the sides & well wooded with elm along the river. River rapid shallow sandy & stony bottom.

Heard a large flock of geese flying overhead long after dark & making a great clamor; reminding one of the stories of fleets of vessels keeping together during a fog by sound of drums &c.

Monday Sept 15. Collected some unios &c in the Souris R. Found among other things a helical shell a few lines (say $\frac{1}{4}$") in diameter formed of sand grains agglutinated together. Thought at first it might be a Mollusc but found that the inhabitant some sort of arthropod. probably a Caddis worm.

Got away by 2 P.M. & Camped after 6 at the River Lake near the "Hill of the Murdered Scout". Met the Ox train of 8 waggons on their way E.

The prairie today may be described as

gently undulating, rather dry with sandy & gravelly soil & thin sod. A large area burned about a month ago & now looking beautifull green from a distance but black & bare when travelled over.
The soil seems to become uniformly coarser with sand & gravel westward.
Many buffalo bones & quite a number of the animals seem to have died of disease or otherwise, so that the bones are not dispersed but all lying near the same spot. Many well marked buffalo paths. General directions N.W ward & N E ward.
At Camping place the edge of the valley in which the "River Lake" lies is very steep & stony. It has evidently been a favourite indian camp as there are many more or less perfect circles of stones about 20 ft in diameter. The stones now deeply sunk in the sod.
From the hill at sunset an immense prospect of prairie perfectly treeless & with an edge purple & perfect as the sea round the whole horizon.
Blue hills visible during the day very far off to S.W.
After dark the glow of a distant prairie fire reflected in the sky far to S.

No wood & only 2 water holes between W. Souris & Wood end. (Several of this St Peters Springs.)
Mail sent on by Scout this morning.

Sept 16. 73 - Broke camp moderately early. Morning cold & cloudy. Intended to go as far at St Peters Springs & there camp. The "Hill of Murdered Scouts" quite a prominent object both before reaching it yesterday, & after having passed it today. The story that some Sioux were camped on the S. side of the "River Lake" Assiniboines on the N. An Assiniboin ascended the hill & lay there watching the Sioux camps, but unfortunately fell asleep. A Sioux wandering round, but unarmed found him, & killed him with a large stone. Said that the Assiniboins have cut the figure of a man on the top of the hill & the footsteps of the Sioux as he ran away.

When about 12 miles out saw a dark object coming behind which on inspection through the telescope turned out to be an Ambulance waggon drawn by four mules, & proved to contain Major Fleming on his way to Wood End. He kindly offered to take me on, so putting on bedding & toilet apparatus deserted horse & carts. He had started from W. Souris in the early morning & drove over the whole 54 miles to Wood End with the same mules allowing them only 3/4 hour rest at noon, & arriving at the end of his journey about 4 P.M.

Found Ward & Russel the civil officers at the English Depot Camps. Ward just on the point of going W. Russel in search of Capt Anderson to complete business with him before leaving

the commission.
The country passed over from Rivo Lake to here may be described as rather dry gently undulating prairie. Good feed still in the hollows but most of the grass quite dead & yellow & looking thin at the best.
The dead prairie grass, however, is said to form not unnutricious feed as on account of the dryness of the air it becomes cured on the ground into a species of natural hay.
The Missouri Coteau forms a distinct feature bounding the prairie Southward & Westward & resembling in appearance the front of the Pembina escarpment.
St Peter's Springs are two well marked water sources filling small pools in the upper end of a coulé the water having a slight alkaline taste.
Where the road passes the springs it runs along the upper edge of a well marked plateau which stretches far to S. & W. & apparently forms a first step of the Coteau level.
Short Creek which the road crosses about 10 miles E of Wood End is very picturesque, being wooded, a deep valley & with many rugged banks & abrupt knolls in it.
Many good sections of Cretaceous clay & one small lignite deposit. The Roche Percé is situated at its confluence with the Souris.
The foliage now assuming beautiful autumn tints with the steep banks of sorrel set brilliantly coloured clays, & sloping banks of grass in

various stages of autumn decay conspired to make the valley look really beautiful.
Wood End Depot is situated on a little river flowing in a deep valley well wooded northward. The stream is called Long Cotton Creek but is really the main Souris R.
Heard wonderful accounts of "coal" deposits in the neighbourhood & found a heap of lignite near the smiths' forge. Saw that many good exposures along the valley.

Sept 17. Rain sleet & snow with bitterly cold wind all day. Carts arrived about noon. Could not do any out of doors work & occupied most of day trying to keep warm over a fire of Souris lignite in a little sheet iron stove. The stovepipe necessitated the keeping open of the tent door which somewhat took away from the comfort.
The lignite which is from the exposure nearest the Camp. It appeared to be almost absolutely free from sulphur but yielded a rather copious light, yellowish ash which rather smothered the combustion in our stove which had no grate below.
Dining under an awning beneath a tree in such weather as this with a servant waiting in a waterproof coat is rather trying in such weather.

Thursday Sept 18. 73 Got various little arrangements made intending to start W. tomorrow. Started about 11.30 with Russel in a spring waggon to visit some lignite exposures about 16 miles N of here where the N.W. hand of the R is.
Passed many stone circles of old tepis, the stones being laid to keep the skins down in old days when skins were plenty. Now generally pegged down for their better ~~[illegible]~~ preservation. Also many indian graves consisting of piles of stones or small Cairns built on prominent points along the banks. Some of the more recent with some sticks still standing among them.
Lighted the horse, made a fire rate lunch & then proceeded to work at exposures.
Left before sunset & arrived at camp before dark. Found that Capt Anderson had got in from W.
Ward left for W about Noon today.

Sept 19. 73. Wrote up notes &c.
Afternoon went N with Russel & examined lignite deposits. Visited new American Camp. Saw Maj Twining who gave me some fossil leaves he had found.
Sent Paul to get about a bushel of lignite from 7' seam for a sample.
Mail from Dufferin with letters & papers.

Saturday Sept 20. 73. Got packing done before breakfast. Left various specimens, insect net & can of alcohol with depôt man.
Got tracing of route & E from Capt Anderson.
Left Camp about 11. Camped for night 14 or 15 miles to West. Day stormy with high cold wind.
The road follows along the S side of Long Coteau Creek, or as it is really the Marais W. Sources. The river represented by pools filling its bed & a small stream running from one to another. Timber altogether ceases about a mile west of Depôt. The valley becomes much shallower as followed & shows no bank having any appearance of sections after about 3 miles W of Camp.
Found a boulder with a few plant remains in the bed of the valley. (Sandstone)
The country gently undulating dry prairie with good sandy soil but grass thin & now quite withered.
Saw a buffalo skull today with the whole of the skin attached, & which probably belonged to an animal killed last year. Many buffalo bones, tracks, & scratching holes.
Party consisting of Spearman, Paul & two photographers with 4 carts.
Shot at some duck this evening but missed.

Sunday Sept 21. Rain in the night, morning cold with a strong N.W. wind.
met Boswell on his way back to Wood End after having superintended hay making for the edge of burned district & travelled on over a black burned wilderness the picture of desolation the whole day.
The prairie fire is said to have run E & W first, then the wind having changed brought the whole line of fire down at right angles across the Commission trail
The prairie is gently undulating at first but on coming to the edge of the coteau becomes quite hilly & continues to show bolder & bolder hills & deeper vallies.
Saw many little marmots or ground squirrels of a light straw colour.
Saw an antelope & tried a shot at it but unsuccessfully.
Found no water for lunch & so had to be content with bread & raw pemican.
Many stone rings & old tepees. Generally near a pool which might contain water & on the southern sides of the coteau hills. Often however in very exposed situations. Also many graves consisting of, or rather marked by, heaps of boulders on prominent hills tops.
The grass must have been thin & poor on this region, the soil light & sandy with a gravel subsoil. The badgers

have brought the latter to the surface in so many places that an exaggerated idea of the poverty of soil is derived from the inspection of the heaps about their burrows.
This hilly Coteau country would no doubt be thickly wooded but for the prairie fires. Many Buffalo bones & now for the first time many buffalo chips of recent origin.

Dr Burgess turned up at Coteau Depot about dark on his way into see the sick man at Wood End. Had supper & spent the night in my tent.

Monday Sept 22. Up before six, Got supplies &c from the depot. Flour, baking powder, beef, oats, pemican.
Got away before nine. The country all day exceedingly hilly road rough & winding. The whole region burned & black. Here & there dried alkaline lakes, their surfaces flat & shiny like snow, surrounded by a scarlet fringe of Salicornea & then by a yellowish border of dried grass giving a most peculiar effect. Especially when viewed from a distance in the midst of the black waste.
Found Col Forrest at water hole where stopped for lunch, on his way West.
Camped at same place with his party tonight. Saw many flocks of geese flying in great triangles Southward but an immense weight & quite hard rubber against the blue sky &

Tuesday Sept 23. 73. Left Camp by 8 o'c
Morning dull & doubtful looking. Passed several alkaline lakes, some dry & some with water. Stopped for noon near an alkaline lake where a little fresh water stream runs in. Steady wilting rain with S.W. wind.
Shortly after noon the wind very suddenly went round to the N.N.W. & became cold. As we went on it continued increasing in violence till it blew a perfect gale the rain at the same time changing first to sleet & then to snow. Found it impossible to ride the horse being frightened by the storm & unmanageable. Led it behind one of the carts & walked on. Reached Leatherstocking-Hawk's old camp with much difficulty & discomfort. Found a good sized wood pile with which made pen. Got tents up. The ground soon white with snow. Horses very cold & crowding round the tents for shelter. A wolf seen near the camp about dark.

Wednesday Sept 25. Morning fine, though still chill with lowering clouds. Things generally disorganized so did not leave till ten o'clock. Col Forrest & party remained remaining to get a batch of bread baked & intending to make a short journey in the afternoon.

Came six or seven miles to the big coulé or ravine & Camped to examine rocks & let photographers take photo. of same. Also to fill baking dione while stalkin country where some wood. Wood struck here is the first timber W of Wood End depot.
Afternoon Ward, of Forrests party rode in being in search of horses six having strayed during last nights storm.
Examined rocks & collected fossils the locality being very interesting.
The gully wild looking & very picturesque with steep scarped banks & knolls of pyramidal form & showing fine section

Thursday Sept 25. 73. Morning very cold with fog. About 8 o'clock began to snow heavily. Managed to collect a few fossils. Thought day too bad to move in & so sent men for a good cart load of dry wood & prepared to make things as snug as possible.
About 11 o'clock part of Col Forrests party came along toiling through the snow having taken the North or American trail on mistake. They reported that two of their party had gone in search of the horses the afternoon of yesterday & had not returned. Col Forrest himself with the rest of his party intended to camp in the Big Coulé where the English trail crosses. Three of the party who had come by mistake & my camp

Camped & we proceeded to determine the next course of action with regard to the lost men. Hampton, Aylmer, Crompton, Chapman & Spearman set off to scour the country in various directions on foot. Got my horse saddled & rode down the valley searching the patches of wood & the numerous lateral valleys. Found Col L. just camping about dusk. Rode back to my camp & arrived at dark very cold & wet, as it had been raining a cold drizzle with high wind all the afternoon. Guns fired at intervals all the afternoon. All searching parties returned having found no trace. Camp which had been dry enough at first turned out to be on a clay bed which with the snow & rain turned into a perfect mud hole involving great discomfort. Got a beacon fire lit on a prominent hill but the heavy rain soon put it out. Hung up a lantern in same place but wind blew it down.

Saw some Americanto auctions going East during my ride, they promised to keep a look out for the lost men, & as they intended to camp at the place from whence they had strayed away I thought they might do some good.

Friday Sept 26. Got packed up & moved camp down to Col Forrests camp about 2 miles South along the ravine. Found a man of Corp Walings party Gray & & gave him a note to Capt Anderson telling him that the men lost & asking assistance of his scouts. Col F. & 6 men besides his two Scouts rode up to scour the Country Southward & Eastward on a systematic plan. The day a little better though still snowing & blowing in squalls. About 2 o'c one of the scouts returned with the lost men. They barely found their way back to the old Camp. They had been out just 48 hours without any food save some half-withered choke cherries & rose hips. Most of the time a snowstorm, varied by rain & all the while very cold. They had behaved very sensibly. On finding themselves lost they wandered until they came to a coulé with some little wood. They managed to light a fire & waited for a glimpse of the sun. This they got on the morning of the third day. Made North to the trail & found the old Camps. They arrived apparently not much the worse & soon got all right again. Fearing they might eat imprudently at first I got some well-tea made with Liebig extract & made them take that with some bread. They were glad to exchange this diet for the rose-hips a few of which they still had in their pockets. They had shot at an antelope & broken his fore leg but he got away. All accordingly glad that our gloomy anticipations concerning them had been unfounded.

Examined a section near the Camp & found typical Schist crystals, crystalline layers &c. I think equivalent to part of Sect B.

Saturday Sept 27. Morning snowing heavily & damp. Decided to start homeward & got off with Col Forrest & party. Had much trouble getting up the steep hill on the W side of the Bravoix having to unpack horses & bring all the carts up in turn tandem wise. Got on slowly with snow overhead & on the ground to Coule about 6 miles W. Decided to camp.
Featherstone & party camped about a mile S Cap. Walling & party about a mile N on the same Coule. Had visits from various members of both parties.
Spearman & Harvey found a bears lair out over about dusk with him hoping to get a shot but Bruin not at home.
Snowing all day damp damn snow. Got fire lit in tent & hung things up to dry. Sewed up mackintosh coat which had been torn to pieces during Wednesday's gale & snow.

Sunday Sept 28. 73. Morning cold with gentle fall of snow. Tent frozen stiff as a board. Gave up idea of starting as from yesterdays experience very little progress could be made over the damp snow. Horses ball up & carts draw very heavily.
Got various little things attended to, clothes dried & got a baking under way as pass last wood on tomorrow march.
Shot a number of blackbirds (of which great quantities haunting the camp), & had them stewed for dinner. They turned out fruity good but rather tough for so small a bird.
Capt Anderson arrived about 10 A.M.
Harvey camped last night at 145 m. coulé.
Much relieved to hear that the lost was found.
Capt A starts West tomorrow morning as his provision train comes up.
Rode down the valley with Forest & Feathersones camp. A high hill on the line gives a splendid view of the surrounding country. The whole region broken into bold hills evidently the remains of an old high level prairie, hills beautiful in outline & covered with snow though most of that on the lower ground gone. Great coulé at feet with steep clifty banks of stratified sands & clays of the Uinta formation. Whole country breaking down into canon like valleys towards the Missouri R., to which the water of the brook on which camped flows.
A very remarkable conical hill near Featherstones

Camp caused by the wearing away of the softer clay strata which the summit protected by a small patch of hard sandstone. Much of which & round cannon shot like balls of concretionary sandstone on the slopes.
Many old camp circles, & piles of stones over indian graves in vicinity of prominent hill. The indians seem to like to camp in a sheltered nook near the top of some conspicuous elevation or hill on the prairie from which a good view could be obtained. Their graves are often on the hills above the camp, or along the salient angles & edges of the bank of some ravine.

Monday Sept 29. Got away about 9 o'c always find that staying in one place even a day renders a punctual start impossible. Soon after getting out of coulé the ground was covered with snow, & on the hills it was about 3" deep. The deeper vallies when viewed from the hill tops were brown & grassy while the remainder of the country was a glittering white. Sun though shining did not appear to have a great effect on the snow. Stopped for lunch on the warm side of a snowy bank, & had to wait a long time for the carts to come up, the harling being very heavy. Though animals so seldom seen in the

prairie, there must be a great number in the aggregate. Today for instance saw many antelope tracks in the snow, also wolf, prairie dog, gopher, mouse & rabbit tracks.
Saw three antelope at a great distance
The wind which in the morning was from the South about 1 p.m. was West, & continued running round till it came from the N.N.W. & became very strong & cold.
Every appearance of a storm, squalls with flurries of dry snow the remainder of the afternoon.
Struggled on till nearly dark when camped in a sheltered valley where there was some feed for the horses.
Kingston one of Forrest's aides was heard to exclaim during the snowstorm, "Oh! Isn't it romantic (?) to think that we're 500 miles from the nearest house!"
The stream where we are camped is quite an important brook or small river in a very wide open valley, with a strong current running away toward the Missouri.

Thursday Sept 30. Did not hasten the start this morning thinking that as it was a fine day it might be well to let the sun melt away some of snow from the hills.
Up a very long ascent with some bad side hills & steep pitches. Carts drawing very heavily through the snow, which on the higher

levels scarcely mulled during the heat of the day but remained hard & crusty.
Some remarkable conical hills, or buttes by the road side capped with hard concretionary & grotesque weathering sandstones. By the help of the sandstone the beds are seen to have a well marked, though gentle dip westward.
Pushed on without waiting for lunch & arrived at 385 mile point between 3 & 4 o'c. Found Galways camp deserted, but a large party of americans under Gregory on their way home, or rather to winter quarters at Detroit.
Got tents up some supper & to bed. Fires small & comfortless as wood scarce having been carried on the carts from the camps below last. The nearest wood is 20 miles back & there is no wood for at least 20 miles ahead.
Night clear, fine, & very cold.
The country passed over from Featherstones camp (351 miles W) to here is very hilly. The hills however are of quite different character to those at the edge of the coteau first passed over. Here the hills are well defined ridges between valleys & systems of coulées belonging to them & all draining away to the south toward the Missouri. The hills are often from 300' to near 500' feet above the streams & form extensive broken plateaus intervening between them with here & there especially northward sustaining ridges & peaks of still greater.

elevation. The whole showing the effect of prolonged denudation acting on nearly horizontal strata of unequal hardness, but generally soft clays & shales. The source of the fine deposits of the lower level prairies.

Wednesday. Oct. 1. Morning cold & temperature in shade not above freezing all day. Took a walk up the stream to get warm, & shot a few ducks. Capt Anderson arrived before noon & camped. Galway & Ward going East came in sight about same time & stopped for lunch. Afternoon examined some lectons a short distance south of camp & got Paul to clear one with the pick from top to bottom of the bank for measurement. Found a leaf bed with well preserved leaves. Measured lignite 8'. Discussed matters with Anderson & got some days rations from him. Decided to stay here a day longer & then return eastward taking places of interest en route.
Wolves (coyotes) routing round the camp.
Some of Col Forsyth's men suffering from snowblindness.

Thursday Oct. 2. Anderson started for Woody Mountain pretty early this morning. Got from him rather short tendays rations for party, including the photographers who are to stay here six days take am photographs they can & then start in for Wood End Depot. As soon as I leave here they will get their portion of the provisions & more on their own account.

Torresto Carto sent back for wood not yet having returned, that article very scarce. Lignite from the bank of the creek coming into general use. The lignite does not however form a very good fire to cook with as it crumbles under the action of heat, & this together with the copious production of ash soon chokes up the heap which continues to burn without in a smothered way. It would burn very well on a grate through which ashes might fall, & which would allow a draught from below & through the mass. No iron or any material for constructing grates being at hand, have to do the best possible by burning it on heaps of pebbles.
Rode off with Paul also mounted, about half past three, intending to get into the Madin Valley & follow it some distance in search of geological exposures & wood. Was surprised to find Lieut. Green & a large American party camped about 3 miles S.E. of our camp & near where the main creek branches. Rode about 7 miles from camp & got a view at least three miles down the main valley beyond stopping place. Valley wide shallow open with no sign of wood or good exposures.
Saw a small pond on which two flocks of geese of different kinds, half a dozen white cranes & a great number of duck. Of course had no gun. Took a few shots at the crowd with revolver but with no

effect. Turned to return to Camp at five. Took the West side of the main valley & followed it up feeling sure that it would conduct into the valley on which camped. As it turned out afterwards another valley running nearly due West (instead of W.N.W. as the right valley runs) branched off near the same place. In the twilight & not knowing of the existence of this valley followed the bank along into it & rode up it a long way till quite dark & I felt quite sure we must have passed the camp.
Moon came out & gave good light though very confusing as part of the ground covered with snow & part bare & brown. Valley rough & swampy in the bottom & creek winding too & so rendering frequent fording necessary. Concluded at last that in right valley but that must have overshot the camp. Worked back along the N side of the valley looking for peculiar clay banks which knew to be near the camp. Came down the valley about 6 miles startling an occasional sleeping duck or prairie chicken & coming unexpectedly on a porcupine which looked strange by the imperfect light. Horses nervous & afraid to cross the water when that was necessary. Of course found no trace of camp. Came at last where the valley opened out wide & the running stream which we had been following could not be found. Decided that must have got into some wrong place altogether, & that last

thing would be to retrace course to a cliff which I knew we had passed on the way up from the main valley before dark. Here to collect some grass & make ourselves as comfortable as possible through the rest of the night, & on the morrow follow our trail back to country which I could recognize. Before adopting this plan determined to go about ½ a mile further to a slope which resembled or appeared to resemble one near the American Camp. By great good luck found that it really was at the American Camp, & were challanged rather sleepily by their sentinel as we crossed the stream to it. Saw a light still burning in Lent Stevens tent. Got him to point out the direction of the mound on the Tangent line. Found the regular road & followed the wheel marks about 2 miles into Camp, where we arrived tired cold & hungry at half past twelve.

Thermometer at 8 P.M. 26°

Friday Oct 3. Having observed by the moonlight last night what appeared to be a very good section of bank, started on horseback with Paul to find way back into the valley in which had been lost & examine the section. Found the

place about three miles up the valley & was surprised to see no less than 18 feet of lignite cropping out in one bed. Also found a fault cutting it off at one end. The first dislocation observed in these strata. Overlying the lignite a bed full of beautiful perfect ferns, & dicotyledonous leaves, but in very soft & crumbling clay.
Rode back to camp over the hill. Saw several prairie wolves at a distance. Lost my pick hammer from the saddle to which it was tied.
Started about 4 with Col Forrest & walked up the camp valley about 3 miles shooting & looking out for sections. Saw some but nothing of peculiar interest.

Saturday Oct. 4. The fossils collected yesterday at the 18' lignite exposure having on account of the soft & crumbling nature of the clay, been all broken up on the way to camp. & Having also lost my hammer. Decided to remain today for the purpose of collecting specimens & recovering the hammer if possible.
Col Forrest lent enough to give me one days rations for 3 men to allow me to do so.
Morning fine but with a heavy storm of wind from the N.W. Got Paul to put horse in one of carts & set off southward to the creek on which the great exposure situated. Found hammer.

Spent several hours collecting fossils, Paul bringing down the bank with a pick. Surrounded each specimen in wadding & wrapped in paper & then packed the whole carefully in a box before leaving the bank. Hope in this way to preserve the delicate fossil leaves till the clay dries when it becomes comparatively hard. Disappointing work however at best. The fossils beautiful & often very perfect when broken out & moist. Loose much of beauty when dry & besides generally fall to pieces before they can be wrapped up.

Day becoming stormy with occasional flurries of snow. Got back to camp by 2.30. Packed specimens & made arrangements for start tomorrow.

Mail with letters & papers for me arrived this evening.

Yesterday was very fine & warm & most of snow melted away. Today colder again but snow left only on the shady sides of hills & visably disappearing.

Many dead antelope found this summer about this part of the country as though they were suffering from some infectious or epidemic disease.

Sunday Oct 5. Got breakfast & away by 9 o'c. Stopped for lunch at 368 mile creek. Found Corps Making party camped there. All afflicted with precious-stone hunting. Had numerous finds submitted for examination. Most quartz & rather poor agates. The latter found near Wood End & Westward, & derived from some rocks I have not seen. Probably connected with siliceous pebble drift. Made the wooded ravine at 360 miles West before dark. Turned South into it & Camped near Lieut Greens party.
The weather today delightful & thoroughly indian Summer. Sun shining brightly & warm in the valleys. Air beautifully clear & the distant hills very distinct & purple tinted. Wind gentle S.W. Patches of snow where drifts have been still on the hills & uplands.
Barom at camp 9.30 P.M. 27.38.

Monday Oct 6. Left Camp about 9 o'c & journeyed on about 10 miles to Pyramid Valley, where arrived a little after 2 P.M. Got lunch & then spent afternoon examining the sections in the valley.
Splendid view from the top of the "Pyramid". A perfect Indian Summer day. Gentle air from S.W. Not a cloud in the sky & sun

almost oppressively warm. Panorama of picturesque outlined hills, grass covered & clear soft blue at horizon.
Found a portion of a neatly made stone pipe on the side of the Pyramid hill. Made of the celebrated "Red pipe stone". Many indian graves on the hills near & this probably washed out on the hillside by the action of the weather. Must belong to an old interment as a little patch of calcareous crust from the soil appears on one end of it. It seems very probable that the peculiar Pyramid hill capped by flat blocks of hard sandstone has been an object of superstitious veneration with the indians & the pipe may have been deposited there as an offering.
Saw a herd of 11 antelope today. They wd came along but far off. Yesterday saw 9 together. They must be quite plentiful in this part of the country.

Barom. at camp this morning 8. AM 360 m. W.
27.23.

Barom at Pyramid valley camp 8 P.M
27.23.

Tuesday Oct. 7. Got away shortly after 9 A.M. & travelled E. by the Line Trail to the 345 mile valley. Stopped to have a lignite bed previously observed uncovered. Then followed up the valley to old camping place. Afternoon collected fossil shells & plants.

Another beautiful Indian Summer day & quite pleasing warm. About 1 P.M. temp 88° in shade. Light variable winds.

Got a tracing of the N end of the Souris from Serj Kay who is camped here doing survey of 6 m belt.

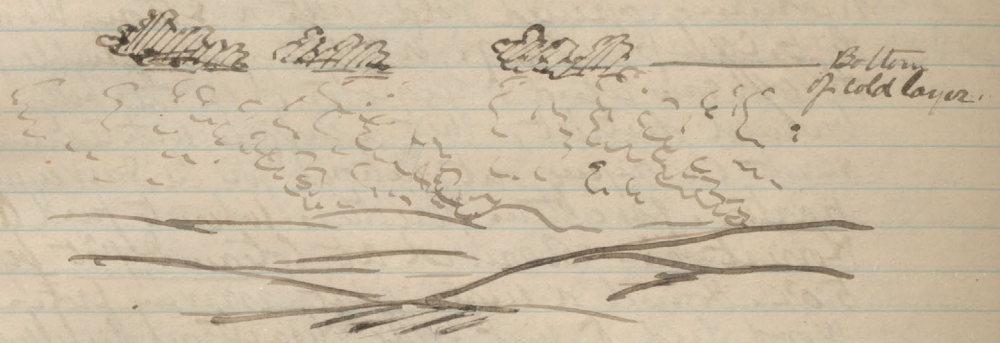
Two of his party by some mischance today set the prairie on fire about 9 miles from here. The wind fortunately not carrying the flames in this direction but a great area of flame visible from the hills & probability that it may spread as far as this valley before morning, especially if the wind happens to change!

Wednesday Oct. 8. Left camp by 9. Followed the N. or American track. On gaining the prairie level found last night's fire still raging, & crossing the country rapidly in a line several miles long, under the influence of a gentle N. Wind. Approached the fire in a direction at right angles to the wind & got over the burning edge easily as the grass short, & the flames travelling

but slowly in this direction. Fine effects of cloud & smoke mingling. When nearly in front of the fire very remarkable appearance smoke rising in series of columns from a thin red line of fire which advancing over hill & valley. Immense columns of smoke here & there. Where the fire going through dry marshes with long grass.
The burned district by this fire extended several miles westward & may yet be enlarged indefinitely if rain does not come. Prairie just burned over & on which no rain has fallen to break down the charred grass stalks looks inky black.
Stopped for lunch at first alkali lake which struck by line from W. Secured a bottle of the water & found it to be filled with minute crustacea. On these no doubt the numerous ducks & plovers on the water are feeding. The wind blowing across the lake has exactly the salty flavour of a sea breeze.
Friend's party on the way in passed us here & afterwards camped at a little lake S of the road. Met Kay's topographers going West.
Off again about 3 P.M. & travelled till 7 before arriving at stopping place where fed (poor) for horses in a swale which had escaped the fire. Camped uncomfortably in the dark.

Thursday Oct. 9. A few showers in the night & morning opened cold with a strong W. wind. Left Camp before 9. Travelling disagreeable from the cold raw wind & monotony of this hilly burned district. Met a waggon with teamster & scout carrying out rations for the surveying parties. Gave them directions where to find Mt Forest &c. Arrived at Coteau Depôt before 5 o'c. Found a mail just arriving from Wood End & met by the disastrous intelligence of the loss by straying of all the beef cattle on the day of their arrival at Wood End from Dufferin. Scouts &c looking for them for several days unsuccessfully. All hands living on bread & tea.

The prairie fire fanned by the strong W. wind has been travelling parallel with us to the S all day. Passing along the Southern side of the burned ground & I dont know how much further S. Last night's rain seems to have had no effect on it. It must have passed nearly 40 miles E today. Great volumes of smoke rising & forming very pretty illustration of the formation of cirro-cumulus clouds. Much moisture evaporated by the heat & as a product of the combustion rises with the smoke. Has condensed on reaching an upper cold layer at some height. Each column of smoke arising from an area of peculiarly active combustion forms an ascending pillar & gives rise to a small cumulus cloud. There lie white & distinct above the smoky layer.



The little unburnt area round this depôt only saved from former fire by unremitting exertions of officers & men. Working along the burning edge with empty oat sacks & finally drawing along the burning fringe a tarpaulin dipped up & filled with water. This by its weight & by adapting itself to the contour of the ground crushed out the fire.

Friday Oct 10. Left the depôt before 9 & travelled 17 miles over the burnt ground to Long Cottau Creek. Found Rowe & party camped there. Lunched. Travelled on till nearly dark & camped beside the stream. Saw the light of a fire a few miles to the W.
The prairie fire which has been following along the S side of the burnt ground has now got past it to the E & shines very

bright directly S of us. Up & out several times in the night watching it as I feared a change of wind might bring it down to the Camp. Day fine though chilly in the morning & frosty tonight.

Saturday Oct 11. Off pretty early. Party of U.S. Cavalry & dragoons who had started at same time from 345 m. Valley passed while at lunch. Their horses & mules much run down, no forage left. Several horses already abandoned by the way. Examined a section in the river bank but found only a great thickness of drift.
Arrived at Wood End Depot about 3. Found Dr Burgess & a few men only. All who could be spared having been sent East on account of loss of beef, of which little no trace. Those here on short rations of beef & probability that soon none at all.
Day beautifully fine warm & calm.
After dark the Prairie fire to the S began to look very threatening. Bright reflection in the sky & lurid glare along horizon. Wind freshening up from S.W. & bringing it directly down towards Camp. Sat up reading & watching the fire. After a time the reflection disappeared but smoke began to fill the air & the moon now risen looked blood red through it.

Went to bed but before long B called me up. Found the air thick with smoke & falling ashes & fire evidently quite close. Got all hands called up & discussed best plan of protecting camp. Camp surrounded on all sides but one by the windings of the creek & there a narrow grassy neck with bushes at the sides. Bushes & small trees along both sides of creek & much dry stuff & withered leaves among them. Thought however that if could stop fire at neck it would not cross the creek anywhere in unmanageable volume. Got clear space cut through bushes at both sides of neck & a broad track across it drenched with water. Got oat-sacks & tied on sticks for "beaters". Put buckets filled with water along the line to keep beaters wet. Wind strong S.W. & fire coming along at terrific pace preceded by volumes of smoke. Whole country to southward seemed one blazing mass. Fire soon appeared like a thin red line over the edge of the valley gaining the crest of the hill in two or three places almost simultaneously. All hands set to work beating but no easy job. As soon as put out in one place found raging on in another. Smoke sometimes suffocating & when the fire in long grass impossible to stand near it. Dry buffalo chips once taking fire could hardly be put out & then served to set the grass going again. Fought the fire from place to place till about 3.30 when all danger seemed

past for the time & the main body of the Conflagration had passed far to the East.
Turned in about 4.A.M.

Sunday Oct 12. 73. Wakened by a fresh alarm of fire between 7 & 8 A.M. The fire which had crossed the Souris, (or Tony Clean Creek) miles to the W was now coming down on the N side of the stream & threatening the camp in another direction. All hands turnout again & hard at work fighting the fire along the edges of the hills & bushes for a couple of hours. Managed to save a piece of grazing ground (such as it is) on the Eastern side of the Camp. Breakfast about 11 & then all turned in. Reading & rest of day.
Lieut Green & party passed about 10.30 having been camped about 10 miles W of here last night on the Creek & having had a hard fight, the fire at one time 18 feet of his tent.
Day fine but strong W wind driving the fire along Eastward. Evening strong glare of fire to S & E, & burning patches in all directions.
Stoves extemporized from Camp kettles & preserved food cans.

Monday Oct 13. Lieut Rowe arrived on way in about 10 & stopped an hour or two.
Went up on the hill with Dr B. & unearthed several indian graves. Found nothing in the first & second, probably not having gone deep enough. In number 3 after removing a great quantity of large & small

stones, found a few fragments of a very thin & delicate skull which had evidently lain in the ground a great while. Could find no other bones & no implements &c. Seems that only fragments of remains can have been buried at first. Below the surface of the ground large flat slabs of stone were lying, one directly covering the fragments of skull found. Spark appeared of great age.
Afternoon got arrangements for rations &c made. Went with Dr B. up down the valley. Got Paul with cart to take in good sample of the 7 foot lignite. Then went about ½ mile further to a section in which Russel had left a note. Found it a good one & got quite a number of fossil shells the presence of which he had noted.
Evening making various little preparations for departure in the morning.
Prairie fire reflected in the sky still in three directions S.W. S. & E.
The lost cattle found & driven in today.

Tuesday Oct 14. Making preparations for start & packing up specimens &c. Packed a box of lignite samples from the 7 foot bed & left it with Depôt-man Mitchell to forward to Dufferin when the horse train & all hands go in.
Left Wood End 11.20. Met a scout

& wagon of Bells train on way to Wood End to carry beef to Coteau Depôt.
Followed the road East the most in about a mile of Short Creek then turned North a little over a mile & struck the Souris R. Chose a good Camp with an unburnt patch of grass & plenty wood at hand. Got some lunch & then saddled up & went to examine a good Section in the river bank. Spent some time trying to find a ford over the R & at last succeeded in getting a place not too muddy or deep. The section of the usual character, & showing three thin Lignites.
Day overcast & threatening. Cold wind in morning & early afternoon, Evening calm & mild with a little rain.
The valley of the Souris R is here wide with many & complicated lateral Coulés. Main valley about 150 feet deep & flat bottomed with the river flowing sluggishly from side to side in a deep trough of its own.
Banks in many places showing sections more or less perfect.
Many musk rats in the R, & the banks covered with long grass, trees & bushes.

A party of traders with 24 carts & vehicles passed Wood End yesterday on their way to spend the Winter at Woody Nut. Today another large party on their way to the same place, which is at present on the edge of the buffalo country. Apparently much frightened by Indians & infested by a colony of Black half breeds.

Wednesday Oct 15. 73. Heavy rain & some sleet during the night. Began to clear up about 8 A.M. Got away before ten. Regained the road to South & Crossed Short Creek. Measured a section in the bank. Camped near Roche Percé Short after noon.

Spent the afternoon examining the Roche Percé & vicinity. Made a sketch of it & copied various indian designs cut upon it. This remarkable rock or rather group of rocks is on the S Bank of the Souris just west of the valley of Short Creek. There are many "peerced rocks" though one in especial is remarkable on account of its prominence, size, & the large openings which have weathered in it. The opposite bank of the Souris valley is also fringed with castellated & fantastic rocks of the same series.

Evening beautifully fine. Scout arrived from Wood End to call in Bell's Waggon train which camped near here for sake of grass. Capt Anderson Col Forrest & Larkey arrived & it being decided to break up the Depot & move in.

Told by one of scouts that many if not most of stone heaps which we have taken for graves are remains of deadfalls for wolves &c. That the plain indians proper do not bury, but hang their dead up in trees, or leave them sitting in lodges. The crees however said

to bury & have often been in this part of country.

Thursday Oct 16. Left Camp before 9 & proceeded down the Souris valley, keeping in the level bottom. Found an old hunters road which we followed, & which took us along very comfortably for about 4 miles. Then came to a place where the river in its winding makes a bend very close to one side of the valley & leaves no level low ground. Gradually mounted the hill in trying to pass this & at last at a very steep & stony place among bushes Pauls cart upset, turning completely bottom upward & laying the horse on his back. All luggage & specimens tumbled out on hill. Got horse out & things put to rights. About fifty yards further the accident was repeated, & the process of getting the animal on his legs, turning over the cart, gathering up specimens & restoring to hot head to be performed again. Obliged at last to go up to the prairie level. Ground covered with multitude of boulders which rendered it very difficult to get the carts along. Found a long & straight coulée running E. & followed this down to the valley of the Souris again. Followed this valley a few miles further, & found some difficult corners till at last finally hemmed in between the river & a steep & very stony hill side. Decided, as the banks of valley here show no section &

do not appear likely to do so, to strike South in morning for the Lone Road. Camped. Made sketch of valley.
Nearly four miles below the Roche Percé another remarkable group of castellated rocks exists, the banks of the valley thus far E. are also of thin bare & stony good sections. Further E. the banks though steep, are grassed from top to bottom & strewn with a profusion of boulders.
The valley where we are camped is considerably narrower than farther W.
Saw today several more specimens of the curious bird which is called here the magpie. It is large, black & white in patches & has a long & straight tail.
Day in the morning remarkably fine & summer like. Afternoon slightly cloudy & unsettled looking. Evening clear & rapidly becoming cold. Last night a very heavy hoar frost, & water frozen more than an inch thick.

Friday Oct 17. Left camp pretty early & went back up the valley about quarter mile to find a place to get up the bank. Had a hard job even at the best place we could find. Tried "doubling up" the horses, tying one one in front of the other. Could not get the horses to pull well together so obliged to unload the carts & carry up the load, then get the carts up light. Scout Pandeen wanted to

"double up" by making fast the front horse by the tail as is always done in such cases by the half-breeds. Said horses pull far steadier & better by their tails than in traces. Asked him if the horses did not often loose their tails. He replied gravely "No, he never saw a horse strong enough to pull his tail off".

On attaining the top of the bank struck S.E. toward the hill of murdered Scout which clearly visible. Had to cross numerous deep & steep sided stony vallies branching from that of the main river.

Reached the trail about a mile W. of the Scout's Hill. Met a wagon going W with flour & found they had a mail with letters & papers for me. Told that Col Forrest Rs on the way E. ahead of us. Stopped for dinner at River Lake then started off again & after a long & cold ride reached the Souris Depot about an hour after dark. Crossed the river with some difficulty. Found Col F & Rs camped. Accepted his invitation to sleep in his tent instead of getting mine put up.

Day though fine in the morning cloudy in the afternoon & with a strong Nd N.W. wind all day.

Several miles along the Souris Valley so encumbered with boulders as to be quite unfit for cultivation.

Talking to Pruden about the mandan indians. The last of the tribe living under

U.S. protection near Ft Benton. Becoming civilized somewhat & cultivating land. Pauden has seen them & says they look much like the Sioux, but many part white among them. Driven gradually W. & destroyed by continual wars with the other tribes which combined against them. They lived more in one place than the other indians, & in lodges of a different kind, being partly dug out underground then sticks & sods built up over the top. Thus the sight site of their villages marked by mounds. Says their chief place was near Red Deer Head Depôt & vicinity. Remains of a village there, & a little further S. traces of a large village protected by an earthwork.

Saturday Oct 18. Got arrangements about rations &c made. Found plenty of everything but oats, of which had to take short quantity. While Spearman baking walked up the R in search of Prairie chickens but found none. Left the Depôt about 11 & came through to where the road crosses S. Cutter Creek (about 22 miles) without stopping, lunching by the way on a piece of ham, pemican & bread. Found Col F. Camped on the creek. Day cold with strong N.W. wind in morning dropping away about sundown. Reflection of a large, though very distant prairie fire to the E & N.
Quite half of the prairie passed over

today & yesterday burnt & black. Pruden says these fires are indians by driving away all game & attributes partly to this the loss by the Scouts at Sours Depot of three horses.
Saw a large Wolf this evening skulking away over the prairie.

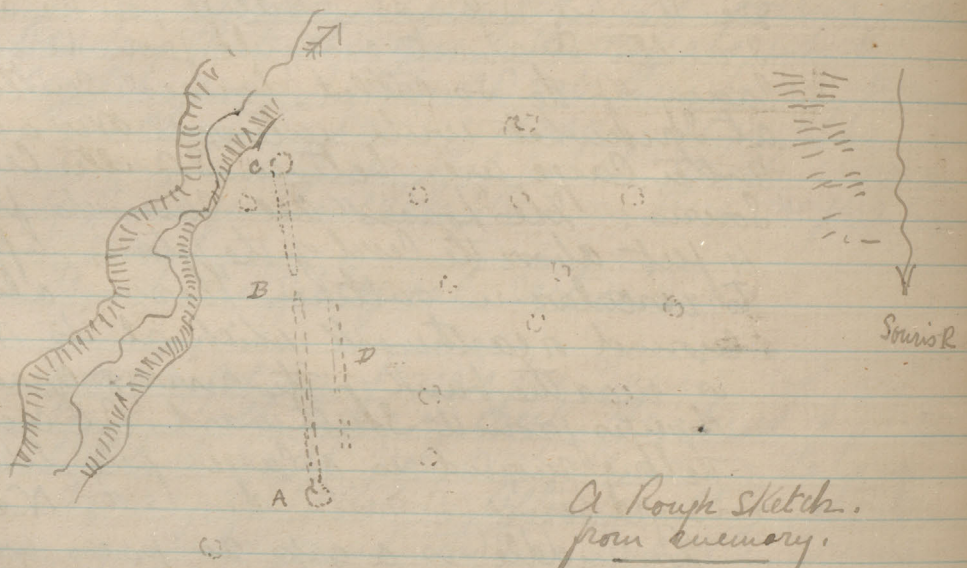
Sunday Oct 19. Made an early start. Followed the usual road for some miles, then struck off E. till reached the S. Antter Creek again. Followed the creek from bend to bend all day & Camped at dusk some 5 or 6 miles from Red Deers Head Dipot.
Found an indian grave of pretty recent date near the stream. The body had been buried & a roof like erection of stakes, strongly constructed, placed over the spot.
The stream of the S. Antter is exceedingly tortuous & meanders in an extensive shallow valley, which in some places has steep banks, but often merges gradually with the plain. This main valley also has its own proper winding so that the actual course of the stream is far from straight. Much good timber chiefly elm & oak along the stream. Musk rats innumerable.
A beautiful quiet indian summer day, quite warm at noon & the air hazy with smoke of distant prairie fires. The purple tracery of the bare trees along the valley contrasting beautifully with the sunny yellows of the aspens.

The country passed over, gently undulating
Good soil bearing rich grass, gravelly subsoil.
Soil specially good in the wide shallow valley
of Creek.
Noticed many large boulders today & yesterday
lying in hollows, as observed before. Found from
Pruden that this due to the buffalo which
scratch around them, & rub their horns upon
them about the pairing season. This also
accounts for the beautiful polish which many
of the larger boulders show on their angles &
edges.
Found no geological sections.

Monday Oct 20. Prairie fire raging not far
off on both sides of creek. Hastened departure
that it might not overtake us in the long
grass of the bottom. After travelling about
two miles found the fire rapidly coming
up behind us, urged by a strong W. wind
which bore volumes of smoke & ashes.
Found it necessary to fire the prairie &
remain on the burnt patch till the main fire
had passed ahead. This it did with amazing
rapidity & we travelled the whole way to depôt
over black burnt ground which half an hour
before had been covered with thick prairie grass.
Fire raging in bushes, & grass on river valley
all round the depôt & kept in anxiety some
time by it.
Capt Hallet with scouts & Bells wagon train
arrived on way to Dufferin shortly after noon

Also found Mahaus party here, & that Col. Lorrests had left 2. this morning.
Pruden pointed out to me several "Mandan houses" along the N. bank of the S. Antler near here. In the afternoon went with him to see the big Mandan village, on the S. bank of S antler & about a mile from here.
Many of the so called "houses" scattered at somewhat wide intervals over a ~~xxxxx~~ rather large area between S antler Creek & the Souris. The "houses" are mounds from 2 to 4 feet above the level of the plain, approaching to circular in outline. There is also a long mound or earthwork which at its N.W. end is near the bank of the river, & gradually diverges from it Southward. At each end of the long mound is a larger pile, like a good sized house, & rather nearer the N. end than the middle is a gap 20 paces wide.
At one place there is an indication of a second inner mound. The whole bears the mark of very great antiquity especially when the permanance of any obstrubance of the prairie sod is considered.
May these erections have some connection with the more southern mound builders, & may not some at least of the so called Lonzies be graves.
Capt Hallet who has seen the remnant of the Mandans in the West says they still build such houses. A circle say 20 feet in diameter is dug out to 3 feet deep. Then sticks placed together as for a wigwam & sods & earth piled

outside. The fire-place in the centre of the floor. The fences are made large as it is customary to bring the horses into one half of the building at night to prevent them from being stolen.



A Rough sketch. from memory.

Course of A.C. about N.W. mag. From A to C 270 yds. From A to B. 176 yds. opening at B 20 yds.
D. appearance of second wall.

Tuesday Oct 21. Left the depôt pretty early, crossed the Souris together with Bells Waggon train. Great part of prairie burned, & a cold cutting N W wind blowing up clouds of black dust. Reached Turtle Hd. Creek & Camped, long after dark

Wednesday Oct 22. Night exceedingly cold & everything frozen this morning, even to the bread. Left camp about 9 10'c. & travelled on all day across burnt prairie. Very cold W & N.W. wind & air full of flying snow-flakes. Passed Cols. Malony & party who obliged to leave two horses behind, played out. Walked nearly all day, it being too cold to ride. Reached Turtle depôt after dark & just as the snowstorm which had been threatening all day came on. Found Lt Forrest camped here, resting horses.

Thursday Oct 23. Snowing & blowing all night & ground quite white this morning. Snowstorm continued more or less all day, but pretty good shelter among the trees. Horses picketed in the bushes eating hay from the stack. Drew 9 days rations for party including Duckworth. Go on tomorrow as far as Badger Creek if at all fine.
Extemporized a stove, thawed ink & wrote up diary.
Had intended doing a little exploration on Long R & Pembina R, but now, unless change in weather must go straight in.

Friday Oct 24. Got away from Depôt together with Waggon train, Col Forrest, Maling &c.
Morning fine but very cold. Thermometer 16° in tent at 8 A.M. & fine parhelia about the same time. Travelled on over burnt prairie all day. Stopped about an hour to rest horses & take lunch & made camp at Badger Creek about 8 P.M. Scraped snow & frozen grass out of tents as well as possible, & made a good fire. Snow barely softened in the sun at midday, & forming large drifts in the valleys. A cold N.W. wind all day.

About 8 miles E. of Turtle hut found two carts side by side near a frozen swamp. On examination turned out to be abandoned. A lot of baggage provisions &c in them, also two guns, & an old tent hung between the carts so as to make a shelter. A tin pan with some dough & a spoon frozen in on top of one cart, & a lot of gofers running about examining things. On one of the carts scrawled "Wood mountain or Bust" & after this in a bracket "Bust by g-d!" No horses or men near. Heard afterwards that a man had turned up at Depôt in the morning asking shelter, & saying that their horses had gone off & he & comrade separated during the snowstorm in search of them.

Saturday Oct 25. Made a pretty early start & arrived at Long R at 2.30 having only 13 miles journey. Took another look for fossils

in the Cretaceous exposure here but without success. Day cold. A heavy flurry of damp snow from the S in the morning. Remainder of day cloudy & doubtful looking with sprinkling snow.
Found contrary to Depot-man Ellis' statement that very few oats here. The scouts in charge appear to have deserted. Found a note from Lieut Rowe dated Oct 22 stating that place abandoned & oats scattered about at that time. Oats when divided at rate of one & 5 lbs per animal for 4 days. Hay in stalk poor & not much of it.

Sunday Oct-26. Camp all up before dawn & off soon after sunrise. Ther. 16°. Venus & Jupiter nearly in conjunction & blazing in the eastern sky. Morning fine afternoon cold & cloudy. Travelling over burnt, partially snow covered prairie. A somewhat prominent hill some miles to S. Called according to Capt Hallet "Dry Dance Hill". Many years ago the indians having held a great dance of young men there. The exercise continuing so many days & nights & no refreshment of any kind allowed. Those falling through fatigue & exhaustion considered as disgraced.
Crossed the Pembina valley before dark. The orange willows & red barked dog-wood forming a peculiar foreground to the blue distant valley-sides. Camped in the dark beside Col Forsyth in a grove of dry poplars.
Much of the plain passed over today, even

that it is burnt presents the hummocky appearance of "Cradle-Hill" ground on which heavy timber has formerly grown. This however is very probably due to the persistent efforts of the badgers, & other burrowing animals.

Monday Oct. 27 Heavy wind & some snow during the night. A cold cutting N. wind with snow flurries all day. Now & then a glimpse of blue sky & some fine cloud effects. Lunch at Horse creek. Prairie passed over today not burned. Reach the old Pembina Hotel, Depôt when nearly dark. Soon surrounded by blazing pine knots & comfortably camped among the snows. Scarcely any water to be had however & obliged to melt snow. Found a mail with some letters & papers.
Many snowbirds frequenting both the burnt & unburnt prairies & very tame. Prairie chickens seeming to be numerous again & flying up before us with their peculiar flight, whirr then rapid strokes & then skimming along with the wings outspread & rigid for a brief period.

Tuesday Oct 28. Up again before dawn
awakened by reiterated cries of "Breakfast!"
which some of the men began to utter about
3 A.M. Off before sunrise. A beautiful morning
without a cloud in the sky. Thermometer 10° F!
The lower prairie looking dark blue &
level as a great sea. Sun warm in the
middle of day but a cold wind.
Arrive at "Grants" about 3 P.M.
A very rocky camp tonight all hands
barely been embedding as fresh as their
pockets would admit of, but fortunately
not much ready money "among the crowd"

Minnamium at Dufferin No. 7

Wednesday Oct 29. Up by 9.30. Morning
mild with gentle showers. Roads heavy
& slushy. Many of the horses "played out"
& were able to move along. Rode ahead of
carts & arrived at Dufferin about 3 P.M.
New buildings going up on all sides for stores &c.

Thursday Oct 30. Reading &c all day. Weather
cold & blustry with flakes of snow.
Hallet & others tell me that the season quite exceptional
Last year a 3 days snow storm in September on
nearly the same day as this year. Yet at time
considered unprecedented & not followed by
another bitter winter in October such as we

are now experiencing. Hallet however says that about 15 years ago the winter came on about this time, & did not break up again. Half breeds generally say that the river freezes over about the 22 of next month. It has every appearance at present of closing up at once.

Friday Oct 31. Writing up notes & arranging specimens &c. Mr Selwyn arrived here with two assistants from his lower on the Saskatchewan. Had taken passage in the steamer from Gary but been frozen in about fifteen miles from that place, & come on by land. Capt Anderson Burgess & party arrived, being the last detachment of parties from the field. Drove down to S. Pembina to make a few purchases & get gun out of Express office. Day fine but cold & windy.

Saturday Nov. 1. Mild pleasant day with a little falling snow. Looking over specimens &c.

Sunday Nov. 2. Cold but fine day. Reading & getting exchanges of plants made with Burgess. An operation occupying some time. Took a walk in the evening.
Min of thermo −18° last night.

Monday Nov 3. Got remainder of plants gone over. Examined & packed birds with Duckworth.

Tuesday Nov 4. Got a quantity of stuff looked over fossils &c packed. A bot guide for plants. Revised Lake of Woods observations on maps. Day bright & fine but cold.

Wednesday packing specimens &c.

Thursday 6. Went to S. Pembina to enquire about stage. Great difficulty in getting passage. All places engaged in advance. Only 50 lbs luggage allowed & express rates of 5c per lb. charged on extra. Would be serious item on collections.

Friday Nov 7. Reading & looked over photograph negatives & wrote requisition for those wanted.

Saturday Nov 8. Got tracing of map of L of Woods from office. Entered all observations on it. Took a walk p.

Sunday Nov 9. Seems almost impossible to get away from here. Stage arriving this evening to start tomorrow morning has 17 passengers. Wednesday's stage chartered through by some person in Gary. Agent says he fears no chance on Friday's. Cannot hear of any person here having teams which might be hired.

Monday Nov 10. Walked down to H.B. Fort with Bergers to make a few purchases but could not get what wanted. Heard of a Farmer called Copeland on the Marais R who has two good teams & might take us to Moorhead. The weather for the last few days has been quite mild & fine. Snow soft & melting all day today. This evening a heavy snow fall taking place.

Tuesday Nov 11 Mild morning. Storm afternoon & evening. Easts party arrived with returning teams from Garry. Stage this evening arriving from Garry Charlotte & carrying down 19 surveyors. Sketching reading.

Wednesday Nov 12. Walked down to H.B. Post & Telegraphed to East to procure seats on Fridays stage. Telegram arrived from Cameron saying that I should go down to Montreal with requisites for routing report.
Afternoon East arrived having been unable to get place on Tuesdays stage, had hired conveyance at $30 the trip. Tried to induce the driver to take us to Moorhead but he would not go.

Thursday Nov. 13. Commenced making section across Red River by making a line of soundings from the ice at fifteen feet intervals. Sketching & reading. Got a telegram from Home.

Friday Nov. 14. Drove down to H.B. Fort with Boswell. Answered telegram from home. Telegraphed to Garry for two places on Monday's stage promiscuously to pay through fares. Drove on to Pembina, did a little business there & returned to H.B. Fort. Found answer from Garry waiting & promising two seats. Brought up commission packet of money for Ward.
Finished section of Red R with help of Burgess & King. Greatest present depth 10'7". Average depth 6'11".
Measured the stump of a very large felled elm on the opposite bank. Greatest diameter 5'4" Least diameter 4'4". Both measurements at 2'3" from the ground.

Saturday Nov. 15. Drew out section of Red R. adding high water levels & from records kept last Spring. Afternoon went over the River with Anderson & Rowe who were shooting. Sent away boxes of specimens by the teams which left this morning. They go to Moorhead to draw up freight & are also taking down a number of discharged men.

Sunday Nov 2 16. Drove to Pembina Fort with Burgess & Boswell Calling at Stage Office to secure places on Stage. Saw Dr Woodruff Capt Marye &c & stayed for lunch. On return packed & made final arrangements for leaving. Thought it not worth while to go to bed, as might not wake in time. A beautiful & warm day.

Monday Nov 17. Left Dufferin with Dr B. at 2 A.M. & drove to Pembina in Ambulance. Breakfasted at 3.30 at "Judge Potters" Hotel. A rambling & unclean looking log house. The "Judge" who dispenses law in this district obtained his appointment as follows. At an election for member of Congress or representative of Dacota Territory he "stood up against the other man for check" & then through some informality in the election of the representative, unexpectedly found himself representative by default. Some aspiring politician wanting Potters vote promised him the Justiceship or Judgeship for it & the arrangement was completed to the satisfaction of all parties save the unoffending people of Pembina.

Stage coach packed & off before 5 A.M. & passengers & a good deal of luggage. Snow beginning to fall. Roads very bad. Travel all day & arrive at Grand Forks after dark. Grand Forks is quite a little village & looks thriving. The Hotel & store are combined in the same building. Got a decent comfortable supper & bed, though the bedrooms were rather primative scarcely divided from each other & very cold.

Tuesday Nov 18.73. Up by 3 A.M. but found stage from S ong arriving, & as the same horses had to return they could not start for some hours. Got away at 7 &c having lost one passenger & gained two in his stead. Day very cold though clear & fine. Supper in a shanty one room kept by a dutchman at Elm R. Night clear starlight very cold. Arrived at Ferry across R at Georgetown. Some time getting scow broken loose from ice. Stage then ran on & hauled over. Arrive at Moorhead after midnight & go over to hotel at Fargo.

The stage journey is rendered more uncomfortable by repeated cries of "all out" when the bridges (nearly all of which are bad) are reached.

Itinerary from Pembina to Moorhead.

Pembina to La Rose's 12 miles.

La Rose to Bickerstaff	miles
Bickerstaff to Kelly's	"
Kelly's to Turtle R	"
Turtle R to Grand Forks	12 miles
Grand Forks to Frog pt	22 "
Frog Pt to Goose R.	12 "
Goose to Elm R	13 "
Elm R to Georgetown	15 "
Georgetown to Moorhead	16 "

Wednesday Nov 19. B & Self after crossing Red R. arrived at Chapin House Fargo about 2 A.M. Walked in & found light burning but no one to be seen. After some time found the care-taker playing cards in a neighbouring Saloon. Thermometer −6° at 7 A.M. Walked about the town bought some photographs &c.

Times very dull here at present, N.P.R.R. about bankrupt & have stopped running trains W of this point for season.

Told of "Coal" occurring on the Riviere de Lacs W of Souris R & near foot of Coteau. A priest who was there last summer says there is much coal.

Told by another person of the Missouri "Coals" found many places on R. & also on line of Railway. One good locality 20 miles W of crossing of Missouri on N.P.R.R.

Thursday Nov 20. J B changed $40 for U.S. Currency. Reading &c Boxes forwarded by wagon train arrived this evening. Made preparations for start in morning. Strong cold southerly wind & overcast sky today.

Friday Nov 21. Breakfast at 7. Walked over to Ingersland & had boxes weighed & checked, leaving B.6 put on other things at Fargo. Train started at 8 & arrived at

Brainard 5:30 P.M. Only one train a day each way of any kind & this runs very slowly & stops frequently & long.

Character of country. The land rises pretty suddenly from the Red R Prairie level, about 2 miles W of Muscoda station (This (no doubt corresponds to the 13 m. ridge E of Bemboina.) No timber on low level prairie & there past Muscoda except in the valley of Buffalo R. Soil often making the rise, thinner, with a subsoil of gravel & sand forming irregular mounds & undulations with frequent small ponds. At Lakeside station the country still preserving the same undulating character begins to be generally timbered. At first many open glades but become fewer going East. About Detroit station the undulating drift-hill character less marked & from this on much low flat woodland & swamps, though also much good & dry land. About Alrich station much low flat land & some regular grassy muskegs.

Timber Spruce, elm, birch, oak, Tamarac &c & toward Brainard much White-pine. From Detroit Westward there are some little settlements & scattering houses along the Railway.

Saturday Novr 22. Breakfast at 6.
Train left 6.30. Thompson Junction between 12 & 1. Changed into cars waiting & travelled on Superior & Mississippi R.R. to St Paul where arrived 6.45. Put up at Merchants Hotel. Saw Keogh of U.S. Cavalry & went with B & him to see Nolan of Senne.
The Country on leaving Brainard continues to become more swampy though for some distance a good deal of dry well wooded ground exists. Beyond Aitkin Stn. Swamp predominates, only here & there a dry ridge or knoll generally covered with white pine. Genuine Munskegs grassy & flat surfaced often partly covered with small tamarac & spruce. Many lakes & ponds. Wherever ridges cut through same yellow sandy drift.
At one place the Railway line has had to be changed. It passed over a swamp where embankment & trestle work constantly sunk.
No settlement from Brainard to Thompson

At Tompson Junction greenish slaty rock suddenly appears rising in small abrupt ridges & knolls like islands above the general swamp level. From near Thomson to St Paul saw no more rock. The drift where cut through of much redder tint due probably to erosion of Red Sandstones of

L. Superior to the N.E. Much of surface covered with swamps & muskeg but perhaps the major part dry & in some places with good timber. The swamps are curiously bounded by steep banks terrace like & flat on tops & a good deal different from those before seen. Soil sandy.
Several thriving, though very young settlements along the R.R. line.

Sunday Novr 23. Walking over the town, & reading. St Paul a straggling looking or new place with many poor & a few good buildings. Several fine large hotels.
Mississippi R not yet frozen over though large ice cakes floating down. The inhabitants make a boast of usually having a December steamboat "excursion".
The town built on the hilly edge of a higher level prairie? plateau. The substratum of St Peter Sandstone, a soft cementless pure white round grained rock crumbling in the hand. It is capped by several feet of flaggy rough looking Trenton limestone & the this is broken through valleys have been formed in the easily eroded St Peters.
In some parts of town heavy banks of clay & drift boulders are seen. The boulders many of them Laurentian & finely glaciated.
Wine cellars &c & the drains of the town are excavated in the soft St P. Sandstone.

a beautiful day thawing a little in the sun.

Nov 24. Went to First National Bank & cashed check for $164.05. Walked about town. Examined & bought photographs &c. Got boxes transferred to W. Wisconsin Ry. Payed on them & had them checked. Secured Ry Ticket. Left by train 8 o'c.

Nov 25. Turned up for breakfast at a station at 5.45. Arrive at Chicago 4 P.M. Leave by Michigan Central 5.15. Country since daylight well cultivated with comparatively little wood, & many thriving towns & villages, especially toward Chicago. Shortly after daylight passed through some fine scenery. Cliffs of purplish sandstone & a lake between which the railway line passes making some very violent curves in doing so. Called the Devils Lake & getting to be a place of summer resort.

Nov 26. Arrive at Detroit Junction at 3.15. Change cars & leave Dr B who goes to Chicago for a day or two. Train goes out Port Huron & thence crosses R to Sarnia. The cars being run out on large steamer. Pass baggage through

Customs without trouble, but find one lot missing. Arrange with officer to pass it after me. Much heavy soft new fallen snow on the line & train somewhat delayed by it. Change cars at Stratford about 9 A.M. Many threwing villages. Guelph an old fashioned looking place with many stone buildings.

Toronto by 2 o'c. One hour late. Get away by 7 o'c train for Montreal.

considerably. No more scarped banks are seen but steep regular grassy slopes. No sections whatever are exhibited, so far as I have been able to examine the valley from this point to a place 15 miles E of Roche Percé. Further E the valley appears to retain the same schouches & uniform character.

So far as I am at present able to judge, would be inclined to place edge of Midyne? Lignite basin about here & attribute loss of section to covering in of Softer Cretaceous Clays &c. The line may turn Southward toward St Peter's Springs, & follow generally the edge of the first rise of the Plain steps above the plain.

Boulders strew the plain & river banks, Southward & Eastward from Roche Percé, in immense profusion. In some places over extensive areas they are almost in contact. Consist mainly of Laurentian but a good many limestone & some of local sandstones. They do not lie as a rule in groups, but appear to be very evenly distributed over the whole surface. Some are of large size. This region quite equals the hills on the Coteau Edge with regard to boulders.
(See Hectors' obs on N. Bank Souris)

slightly higher level there. They probably dip Southward at a low angle & underlie the section before given from Short Creek.

(See sketch of rock. Also photos:)

The rock & others near it is covered with Indian marks & pictures of animals &c. There are also a few names carved on it which were there before this summer, & many which various men on the Survey have seen fit to carve.

Oct 16. The Souris Valley for about 4 miles E from Roche Percé continues to show many sections of the usual clays, sands, & hardened sandstones like those of the rock itself. Nearly three miles E another picturesque group of rocks is formed by the Roche Percé beds. Found in several places sections of rather hard greyish sands & sandy clays underlying the R.P. sandstone belt. In one place a layer very full of paludina like shells. Collected a few of the most perfect. (Specimen V. 96)

Further E the valley changes its character

Oct 15 Roche Percé. The group of rocks so disintegrated derive their curious form from the weathering away of a soft incoherent grey sandstone from below. Some harder sandstone beds of a yellowish tint (on weathering) & owing their superior durability to calcareous cementing material.

Both the upper & lower sandstones are false bedded & much resemble in many respects the false bedded sands of Pyramid Valley.

The upper sandstone also appears to be hardened in a somewhat partial manner. Belts of harder rock several yards in width, running nearly parallel in a N.W. direction & seperated from each other by spaces were easy of disintegration. There is also a system of jointing at right angles to this structure.

The combination of these circumstances has given rise to the remarkably castellated, fantastic & picturesque rock scenery. The hard belts form tongues projecting diagonally from the bank & the weathering of the soft sandstones along the cross joints has formed numerous window like openings through them.

The N. side of the Souris valley for some way up & down is also fringed with similar rocks. The sandstones appear to be on a

Sections of this formation looks much better defined from a little distance than when carefully examined. A bank often appears to show well marked beds from top to bottom, but on examination proves to be made up of successions of clays graduating into sandy clays & very fine sands between which it is almost impossible to draw distinctions in a measured section.

Many small pellet like concretions are to be found on this bank & derived from it. They are blackish grey in colour & in the main have a calcareous cement.

9. Good hard lignite 2'2"

10. Hard yellowish sandy clay 2'7"

11. Good lignite 4'9"

12. Greyish sand & sandy clay showing stratification. In some places soft. but some with large concretions, & often forming a nearly solid sandstone 9'

13. Hard grey clay 2'

14. Greyish yellow Clay with many thin layers of leaf-like orange weathering ironstone 3'

15. Lignite 2'6"

16. Greyish & yellowish hard sand & sandy clay 11'

About 12' to level of water in Creek.

Many banks in Short Creek covered with red ochery rocks & talc like fragments of slates indurated by the local combustion of the lignites.

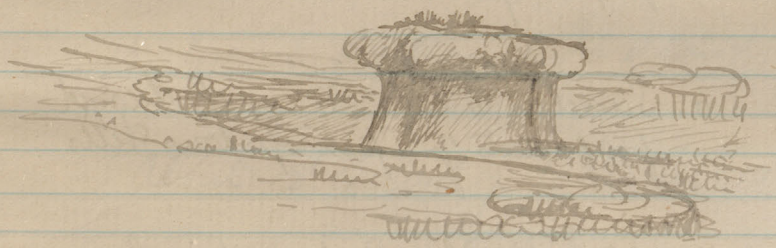
This section as is generally the case with the

Section on W. Side of Short Creek near the Road. From near the general prairie level, descending.

1. Soil	18"
2. Yellowish somewhat coherent sand. Grey externally. Some much shattered remains of unio like shells at bottom.	12' 6"
3. Grey Clay	2' 10"
4. Yellowish & greyish thin bedded sands & sandy clays with several clay like, orange weathering ironstone layers.	6'
5. Grey clay	2' 4"
6. Similar to No 4. with decayed fragments of Gastropodous shells	12'
7. Also similar but with a large number of thin ironstone sheets	3'
8. Hard yellowish sandy clay, a few inches at the top carbonaceous	10'

of a bed which has been denuded away from the top.
The section as a whole much resembling that seen near Wood End & & evidently belonging to the same series.

Oct 15. The sands & soft sandstones on the S. bank of the Sources & over a mile W. of Slate Creek begin to assume the Roche Percé appearance. Soft beds weathering from below & leaving tabular masses slightly supported. The same thing may indeed be seen as far W. as Wood End, where about 1½ mile S.W. of Depot the rocks in a wood have a similar character.



Oct 14. Souris R a mile or two West of Short Creek.

Banks show sections more or less perfect in many places. All appear similar though not exactly the same. Examined one of most perfect. Bank say 60 to 70 feet high. Composed of sands, sandy clays, & hard fine clays: Very regularly stratified. Yellowish, greyish & whitish. Harder ~~sandy beds~~ sandstone beds at two different levels.

The bank showed three thin beds of lignite. The lowest 2' 3" of lignite of very excellent quality & superficially resembling cannel coal. (see specimen) A few feet above this a second lignite of 18"

About half way up the bank a third bed also 18" in thickness.

The clays & sandy clays at several different levels showed remains of shells. Much crushed & decomposed & impossible to obtain as specimens. Seemed to be of same kinds as observed yesterday, but the large bivalve unio-like shell much commoner here.

The hard sandstones more or less nodular & at the top of the bank two or three large spheroidal nodules like those seen yesterday: lying loose. Evidently nearly in place & have formed part

Oct 13. Visited a section two or three miles N. up the valley (marked H on sketch) mentioned by Russel.

Russels measurement gives. descending.

Sand & sandy clay (yellowish)	40'
Ironstone (lenticular, measured at thickest part)	$2\frac{1}{3}$'
Sand (greyish)	2'
Shell bed of hard sandy clay	$1\frac{1}{2}$'
Lignite	$2\frac{1}{2}$'
Sand & clay	10'
River.	

Collected a number of the shells. Both bivalve & univalve represented, but the latter preponderate, & especially a shell like melania? The shells are harder & better preserved than any yet seen in this formation, & have a fresh water aspect.

In the brook opposite here several large spheroidal sandstone concretions form some neighbouring bank. One of them 4' or 5' in diameter & oblate.

Oct. 11. 73.

Section in bank say 50 feet high on Long Coteau Creek, or W. Souris. About 3 miles W. of Wood End Depôt.
Appears to be entirely composed of yellowish sandy & gravelly drift with boulders, & rather hard & compact in places.
Much resembles in composition the Long R. section but exposure not sufficiently perfect to see false bedding or if it exists.
Laurentian, limestone, a good deal of "silicious pebble drift" & some fragments of hard sandstones from plant bearing series.
Many stones glaciated (see specimen)

Oct. 12. Banks immediately round Wood End Depôt of similar drift. Many fine glaciated boulders. Observed glaciated pieces of sandstone, limestone, gneiss, & "silicious pebble" (Quartzite.)

The irregular abrupt hill & valley region of the coteau edge. Composed apparently of drift materials & showing usually no defined drainage system; may be considered to extend on the line from about 335 m. W to 290 m. W. Thus forming a belt 45 miles wide.
The region is specially that of the alkaline lakes, though alkaline patches on the soil & efflorescences are not uncommon both E & W of it, especially in the valleys of rivers & in coulées.
Many of the hills in this region seem almost entirely composed of boulders & gravel. Material mostly Laurentian, a good deal of white limestone & slight admixture of "siliceous pebble drift" Soil filling interstices yellowish sandy.

The upper third of the section is composed of softer yellowish fine sand, forming generally a sloping bank & not well exposed. Its upper portion however consists of a layer several feet thick of hard sandstone breaking into subtriangular fragments, & thus it is which forms the cap of Pyramid hill.
It is very probable that this hard sandstone is the same seen about 4 miles W. of here forming the capping of several hills & dipping away gently to the west.
It is conspicuously false bedded.

The rocks in this section show no well marked dip though undulating somewhat.

The occurrence of gypsum as selenite is nearly always in association with plant beds, & generally with those holding many half-obliterated plants, & of a purplish shade.

This section as a whole appears to correspond with the upper part of that already described in the red Cerro Cordé E. formation. 345 m. valley

generally pretty coarse. This sandstone is false bedded through its entire thickness, but the false bedding is cut off in many places by perfect horizontal planes, & then recommenced. The weather acting on these beds, causes the hill sides composed of them to assume a well marked terraced character, each horizontal plane forming a terrace level.
The sandstone shows here & there a few badly preserved shells (see specimens). In one place a layer of ironstone about 3" thick is seen to run for some distance.
The most remarkable feature however of this part of the section, is the concretionary character of the sandstone. The concretions are hard & of all shapes & sizes. A few are spherical, mainly flattened spheres. Often confluent forming clump-bell like masses & sometimes sheets of a clumpy character running for some distance horizontally. Often long & root like & projecting strongly from the bank.

7. Purplish bed with obscure remains of leaves. 1'

8. Grey slightly coherent sand with nodules of arenaceous selenite crystals 4'

9. Purplish-grey laminated sandy-clay with plant remains 2'

10. Yellowish grey soft sandy clay 6'

11. Purplish bed with a few plants 2'

12. Lignite with many spots of amber in places. 18"

13. Purplish plant beds with thin lignites & much selenite in sheets & isolated crystals & groups of crystals 3'

14. Stratified sandy clay 3'.

52'

This section forms about the lower third of the whole section shown in the banks of this valley.

The middle third, overlying No 14. consists of soft incoherent sandstone, grey in colour &

Oct 6. Pyramid Valley 350 m. W.

Near the line of Lat 49°. This valley is much broken & shows good sections in the banks. The most conspicuous feature is a remarkable conical hill standing out between the edge of the valley & the stream below. It is caused by the weathering away of softer soft sandy strata, the top of the pyramid or cone being formed by an outlying block of the capping sandstone which is quite hard.

Section exhibited in the banks of "Pyramid hill" ascending from near the water level in the brook. (Measurements are approximate)

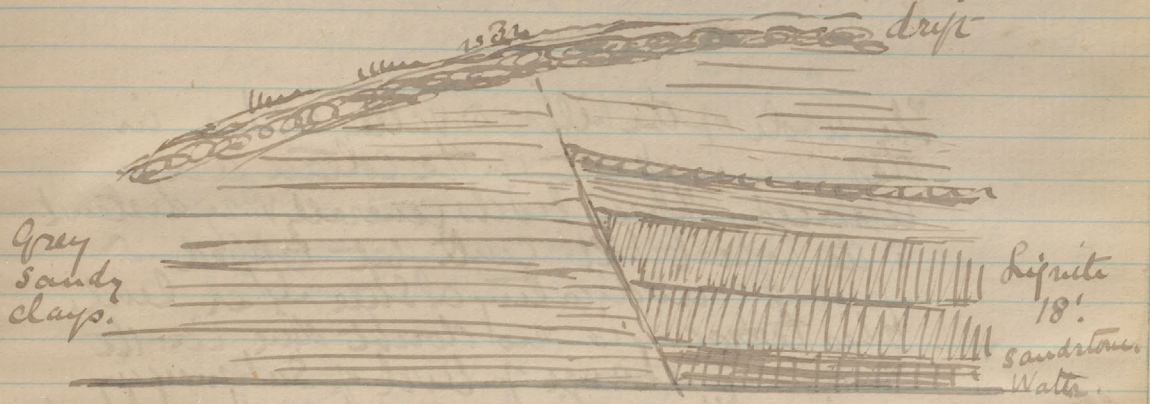
1. Grey somewhat coherent coarse sand with argillaceous matter	12'
2. Brown earthy bed	6"
3. Lignite	1'
4. Brownish clay with some ferruginous layers.	6'
5. Purplish grey sandy clay with obscure plant remains & some fossil wood	3'
6. Incoherent sandy clay, & sand	7'

over

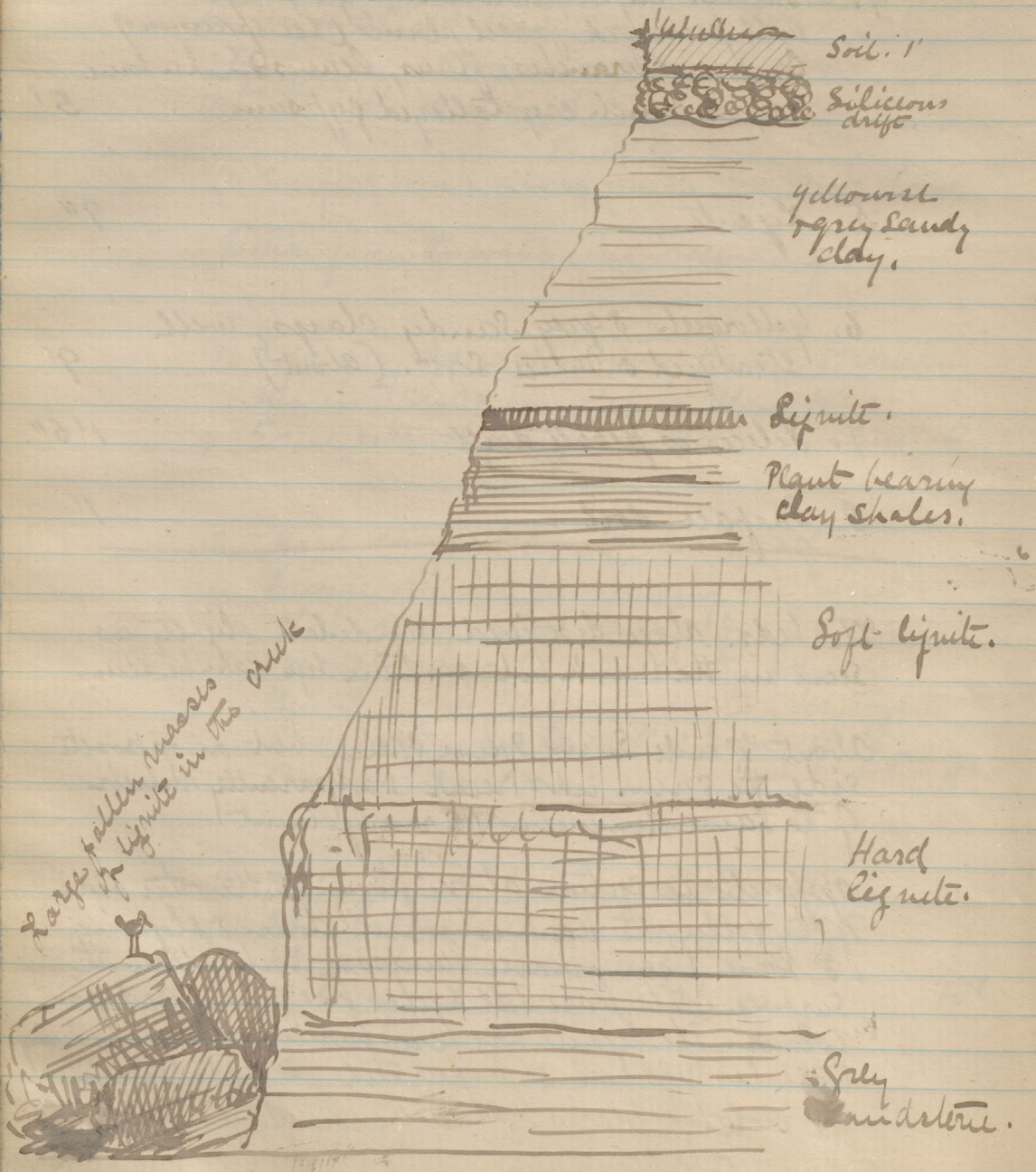
Oct. 5. 360 mile valley. Some imperfect sections showing yellowish & grey stratified sandy clay. In one place a small exposure of ripple marked sandstone. Ripples very distinct & perfect. Direction, at right angles to length S.W. (mag)

The whole of the hills & valley sides in this inner part of the colean are terraced. Three levels generally very distinct & the highest hills quite flat topped & probably indicating a still higher level. This terracing is no doubt due in the main to change of level of submerging water. The varying hardness of the almost perfectly horizontal strata of the district & the occurrence of hard sandstones at some levels, helps the formation of terrace benches much. Some may be due to this cause alone.

At the Western end of this bank the 18 foot lignite & associated beds are seen to be brought suddenly to an end by a fault.
The lignite is thrown down to the N.W. & grey stratified sandy clays appear instead.



Several exposures apparently of same character as that seen near the camp, west N.W. up the creek. A lignite bed reported about 4 miles up from the line which I had not time to visit.


Soil. 1'
Siliceous drift
yellowish grey sandy clay.
Lignite.
Plant bearing clay shales.
Soft lignite.
Hard lignite.
Grey mudstone.
Large fallen masses of lignite in the creek

4. Banded clays, yellowish grey & purple with well preserved fossil plants (see specimens) Coniferous branches, ferns, leaves &c. In some layers much crystallized gypsum 5'

5. Lignite 9"

6. Yellowish & grey Sandy clays, well stratified & rather soft. [about] 9'

7. Siliceous pebble drift 1'6"

8. Surface soil. 1'

The beds above described undulate slightly as seen in the bank but no true dips can be seen.

About ¼ mile E. in same valley but on opposite side the same beds recur & apparently much of the same dimensions & arrangement.

Opposite the section above given, on the other side of the valley, the bank is broken down & sloping & some remarkable lumps of rock strew the surface. The bare hill sides are quite red in colour. The lignite has here burned away, leaving the shales reddened & indurated so as to form the isolated blocks. Also accounts for breaking down of valley edge.

Oct 3 & 4.

Section in valley of Creek South of Porcupine Creek, & which branches from the main stream near the same place & runs up into the hills Westward.

A scarped bank along the foot of which the creek flows.

Section from the water line ascending.

1. Soft grey Sandstone very jointy & breaking out in pieces bounded by plane faces. Some vertical & oblique root like remains 5'

2. Hard compact lignite horizontally laminated but also breaking into cubical blocks along vertical planes. Here & there a jointage face coated with Selenite. Saw one small fissure filled with pyrites. Very tough & compact under the pick. Small spots of amber common. 8'.

3. Softer lignite forming a steep slope, some layers laminated others soft & brownish. Of poorer quality than the preceding. 10'

Siliceous pebble drift is now replacing or has now replaced the Laurentian Princeton gravel in further East. Laurentian Dr. boulders are however still to be seen on the surface.

The siliceous pebble drift is composed of well rounded & waterworn pebbles of quartzite, or material resembling it & of yellowish & brownish prevailing colours. Also frequently fragments of silicified wood (see specimens).

If this drift is derived from rocks belonging to the Lignite series, they are beds which I have not yet observed in place.

6. Impure ironstone in concretions 3"

7. Yellowish sand & sandy clay with obscure plant remains 9'

8. Greyish & yellowish fine sandy clay 1' 3"

9. Layer of small disconnected ironstone balls

10. Grey fine sandy clay 1'

11. Rusty layer with crumbling plants 3"

12. Grey sandy layer 4"

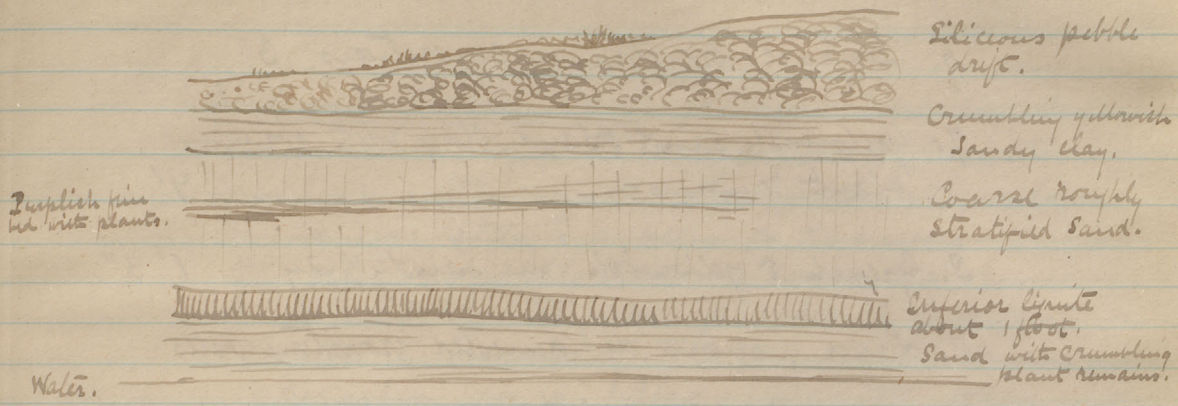
13. Detached masses of lignite showing the form of flattened tree trunks about 4"

14. Yellow grey fine sandy 6"

15. Grey clay with plant remains 4"

16. Lignite, not of perfect quality, undulating slightly. The grain & form of the component wood generally clearly perceptible, much more so than in Wood and Lignite. (about) 3' to 4'

17 Soft grey sandy clay.



The bank about 15 feet high

Section a little further N in a bank about 20 feet in height.

Below the soil. Siliceous pebble drift.

then.

1. Soft greenish sandy clay 2' or more
2. Soft blackish clay 1' 6"
3. Rusty crumbling sandy clay 6"
4. Grey clay with some plant remains 9'
5. Grey clay with well preserved dicotyledinous leaves about 1' 8"

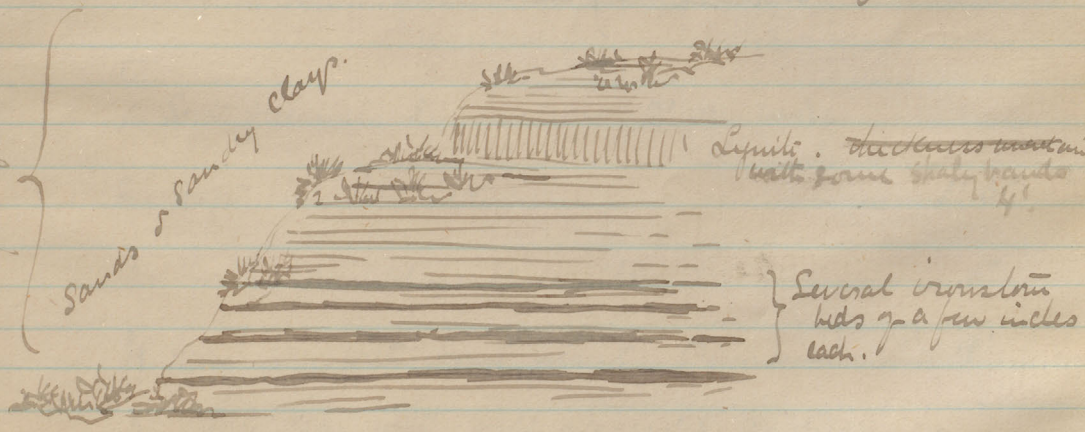
Oct. 1. 73. Sections on banks of "Porcupine Creek" 487 m. West from Red R.

Lignite seen in the banks at three places near the line & reported in others.
The three exposures mentioned occur on the E. bank all near the water level & apparently represent the same bed. The bed undulates slightly in all the exposures & varies in thickness from nearly 4 feet to about 1 foot. The thinnest portion lying furthest S. & about ⅓ mile South of the line.
The associated beds are yellowish & grey clays & sands, generally very fine, well stratified & fairly resembling the beds of the upper portion of Section at 345 mile Ravine. Found one bed containing well preserved fossil leaves, of which collected a few.

This equivalency would show that though the lignite deposits may not be individually of great constancy, they persist on about the same horizon over a great extent of country.

About 2 miles South of the sections just described & on the W. bank of the 145 m. Coulee where the line trail crosses it. Sections occur which however I had time only to examine slightly.

There are more important intercalations of ironstone than elsewhere seen in this valley, & at a short distance above them a bed of lignite which was completely hidden by the falling over of the bank & would not have been discovered but for the heaps of decomposed material of a black colour brought out of their burrows by the gophers.



Many of the crumbling hill tops in this valley have a brick red colour similar to that seen frequently near Wood End. This I think arises from the alteration of the shales due to combustion of lignite beds in place. The lava-like scoria due to the same cause is also found though not observed in place.

<u>Probable relations of Souris R sections with those.</u> From a comparison of the sections at the two places it seems almost certain that the W. Souris beds represent those of Sect. B. They are exactly analogous in every respect. Both lignite bearing, of same colour & composition, similar plant remains & thin soft "leaf beds" much distroyed remains of shells also occur in some places in connection with the W. Souris deposits.

? If the Rocky Pierce Sandstones overlie the chief lignite bearing strata seen a few miles further west; they are probably represented in Sect B. by the upper concretionary Sandstones.

Found also in a few places sparing remains of shells in a very crumbling state, but some I think recognisable (see specimens)
The fine sandstones of the upper part of this section are often hard & concretionary in character & some layers even assume the appearance of sandstone.
Section A is a group very marked & easily recognisable on account of their distinct & peculiar colouring, & from the fact that the hard sandstone layer capping them often causes their preservation which all the rest have been denuded away.
The lower part of the section from 1 to 9 inclusive has a very well defined grey-purple tint, which contrasts strongly with the bright whitish-yellow or grey colour of the remaining portion

The plant remains though occurring more or less throughout the whole series are best preserved in the lower purple beds of Sect. A. They consist for the most part of leaves of dicotyledonous trees among which I can I think recognise cinnamomum ?
There are also flag like blades & branching whorled plants often standing upright in the beds & probably equisetaceous.
Remains of coniferous leaves (Sequoia?) are also common.
On the whole the organic remains would seem to point to tertiary age & very probably to miocene tertiary.

grey colour & well stratified.
They contain thin "leaf beds" at several different levels. These are prominent from their grey-purple colour, & though containing great quantities of dicotyledonous & flag like leaves do not yield recognisable specimens on account of their soft & crumbling nature.
There are also in this place in Set B at least three lignite beds.
The lowest of these is about 15' above the Sandstone (B Sect A) & is only a few inches thick.
The next is about 60' above the same datum & can be traced a long distance along the face of the bank. It is 5' thick including however at the place examined several thin layers of carbonaceous shale & though very good in places is not constant in character vertically.
The next (& highest observed) must be about 20' higher than the last. It would appear to be of fair quality though much decomposed by weathering at the surface. The bed is over 3' thick the bottom not being exposed.
(See specimens)
Sect. B. also shows small quantities of ironstone & some gypsum (Selenite) in cracks of the clay, & also as crystals through its mass.

2 13. Hard grey false bedded (slightly) sandstone forming the cap to this portion of section, say, 3'

The whole of the rocks show a slight but still well marked dip to the S. but ward, (on the N side of the valley)
(Oct 7) On the S.E. side a little further down the dip N.W. ward. On the whole the valley seems to occupy a shallow synclinal.

1 Section B. 345 m. Coule.

This section is the continuation upward of Sect A. & at this locality is best seen on the S.E. side of the valley, or that opposite to Sect A.

Upward from bed 13 Sect A the section consists of at least 100' & probably 150' feet of clays & argillaceous fine sands of greyish & yellowish

10 5 Thin bedded greyish & blackish hard clays with leaves & some small bunches of selenite crystals. 7'

9 6 Hard whitish clay with some plant remains & a scattered layer of heavy ironstone balls about a foot from the top. (Some Wavellite in cracks of ironstone) 9'

8 7. Harder, pale-brown compact clay with very few plant remains graduating into 1'4"

7 8. Greyish thin bedded clays becoming blackish at the top. Plant remains 10'

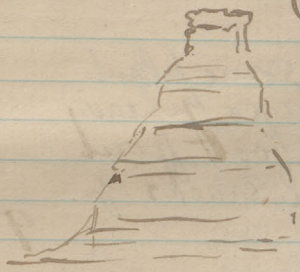
6 9 Blackish do. do. 5'

5 10. Greyish & yellowish bedded clay Hard. 2'6"

4 11. Soft yellowish sandy clay 2'4"

3 12. Greenish yellow finely stratified fine sand 15

preserving the top of each bed giving a profile, steps according to its consistency. Roughly in this way.
(See photo.)



Above the sandstone comes in a great thickness of sandy clays & concretionary sandstones enclosing three lignites of various thicknesses & as far as I can judge corresponding with the portion of strata seen about Wood End & Roche Percée. ?

Section A 345 mile Coulé

Section from the lowest beds upwards.

14 1. Say where first seen about 50 feet above bottom of Coulé. Softish grey clay

13 2. Ironstone with many plant remains, mostly dicotyledinous leaves & flaggy blades. Say 2" to 3"

12 3. Grey hard sand with charcoal like fragments in places 3'

11 4 Fine bedded clay filled with leaves & plant remains, becoming hard & rusty in the upper portion. 1' 8"

even the hills however would afford fine grazing in early summer.

The high broken hilly ridge which is seen at first to the south of the line appears to cross near Cotean Depôt & as far as todays march is still apparent running at a considerable distance to the N, & apparently with a course not far from E & W.

About 2½ miles from the 339 mile Camp the N trail descends into the bottom of a coulé which expanding & receiving lateral branches Sooy leads into the great 345 mile Coulé.
The scenery very picturesque & fine sections of the banks exhibited.

The lowest beds seen (which are at some little distance above the bed of the coulé) are curiously purplish clays & shales. Then greyish & yellowish beds with hard sandstone capping them for a few feet.
This portion of the section has in several places been worn into curious stepped pyramidal mounds. The sandstone

scale. Not to stretch the analogy too far, may I mistakenly taken to represent the bulging trunk or flemish Cap.

The seperation of the surface of the sod into polygonal areas & sundracking is very evident along the hills wherever hollows sufficiently pronounced occur. The areas are often several yards in diameter, well defined, & when examined generally appear to be pentagonal in outline.

The coteau country appears to become higher & more broken Southwards.

823.

Sept 23. The coteau retains its broken & irregular hilly character to within 4 or 5 miles of Leatherstone-Haughs 339 mile station. It is not however nearly so steep as at first, & gradually subsides from its rough & broken character to a somewhat boldly undulating prairie which is not far below the level of the coteau hill tops, & is in fact the third great prairie step. Prairie of this character continues from where it begins to the 345 mile creek or ravine. The soil gravelly or sandy & sustaining but a thin growth of grass except in the hollows.

old river valley, about a mile wide, & considerably over 100 feet in depth crosses the trail.

Altogether so far as yet seen the Coleau hills look more like an immense aggregation of moraine mounds than anything else. They cannot be moraines however, as they show no general direction, such as they would be obliged to assume in front of a glacier.

The hills seem to consist of rolled gravel & boulders.

May these hills not be to submerged arctic America what Newfoundland banks are now, & formed in the same way. Cold arctic current flowing S between Rocky Mts & Cordilleras (resembling Labrador coast) & Laurentian axis (representing Greenland) meets a warm current which flowing from S.E. against the Rocky Mts is diverted, (like the Gulf Stream) Northward. Where the cold stream flows beneath the warm the icebergs are left to their fate, melted, & their loads discharged.

The general appearance of the country like that seen on approaching Fortte Mt from the E, but on a larger

Sept 21 & 22. 1873 Coteau de Missouri.

The prairie about Wood End Depot appears to belong to the first rise toward the coteau, though certainty as to this could only be arrived at by levelling. Soon after leaving the Long Coteau Creek, or Burns R., the prairie becomes more & more undulating & appears to rise gradually. This continues till in a few miles one finds himself in a confusion of abruptly rounded hills. These appear to culminate about Coteau depot. About five miles beyond that place the trail arrives at about the highest level & the hills are seen to be flat topped & nearly of equal height. The trail cycles diagonally from this.

The hills to all appearance consist entirely of drift material. Many lamentaceous boulders & much gravel & some boulders of white & yellowish limestone. Few or none of the stones have a local origin.

About Coteau Depot the hills are very abrupt & accending & stony, often appearing to consist of piles of boulders with barely a filling of earth. West of this the hills become less abrupt, gently rounded & stones not so plentiful.

The hills are often confused but when showing any general direction appear to tend N & S.

About 7 miles W of depot a well marked

Coal for the smithy has been taken.
(See Sample)

All these beds of lignite deposits seem though often showing slight undulations to lie as nearly horizontal as possible.

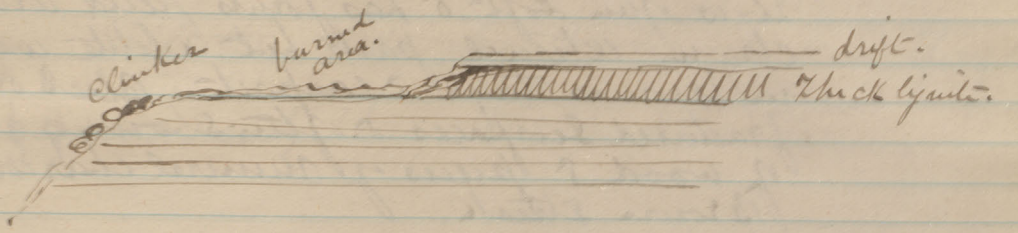
along the bank & is pretty well shown again at C where it has much the same thickness & appearance.
It is often soft & has joints filled with clay in external parts but a little way in becomes tough & compact. Black on fractured surfaces & often showing grain of wood & pieces of mineral charcoal. Brown streak.

At point marked B. on opposite side of river valley upper part of bank shows good section of sand sandy clay, & 15' or 20' below prairie level 4'7' of good lignite.

At point A say 16' above the river & near the foot of a bank apparently consisting of same sandy clay & say 60' high above the lignite to prairie level.

Lignite 3' feet visible from top of layer & bottom not seen. Seems of good quality but much weathered. From this place

overlying lignite, in the way (theoretically) indicated in annexed section.



<u>Exposure at point on Plan marked D.</u>

Drift material below prairie level about 8'

Yellowish & grey stratified sandy clays slipped in most places. 52'

Good lignite 7' 3"

Grey soft unctuous sandy clay below the lignite one foot & more

↓

The bottom of the lignite bed is about 25 feet above the river level but there is no section. The lignite is seen in several places

small bright yellowish dots of fossil resin or amber.
Ironstones specially good & compact

No. 2. lies almost immediately below the drift & roots go down through it in many places it is soft & ironstained but probably good where not weathered.

This section does not appear to correspond at all with the first & the difference appears to be due to the horizontal uncertainty of these deposits.

18 appears to be a true underclay but may be only a layer with thinly disseminated & tangled vegetable debris.

Many fragments of a lava like rock appear in this vicinity. It appears to be the product of the combustion in situ of lignite beds & is really a vesicular clinker formed by the fusion of their proper ash & the mineral matters of surrounding layers.
One part of the bank showed a specially great quantity of this material & it appeared to lie opposite a hollow in the prairie above. The hollow had probably been formed by the combustion of the thick

8.	Carbonaceous shale	1'
9.	Grey soft sandstone	1' 8"
10.	Lignite	1'
11.	Grey & yellowish laminated Sandy Clay	5'
12.	Ironstone (nodular)	3"
13.	Lignite (good)	1' 7"
14.	Carbonaceous shale	1' 6"
15.	Lignite (good)	2' 2"
16.	Grey Sandy Clay	2'
17.	Lignite (good)	1' 5"
18.	Sandy underclay with large & small roots badly preserved. about	18"
19.	Lignite (good)	3' 2"
20	Greyish Sandy Clay.	

(See specimens bearing numbers as in section)

The lower lignites show in many places small

The bank forming the point of angle between the main Souris R & the Creek coming from N.W. shows a section of sands & sandstone & fine sandy clays but no lignite apparent.

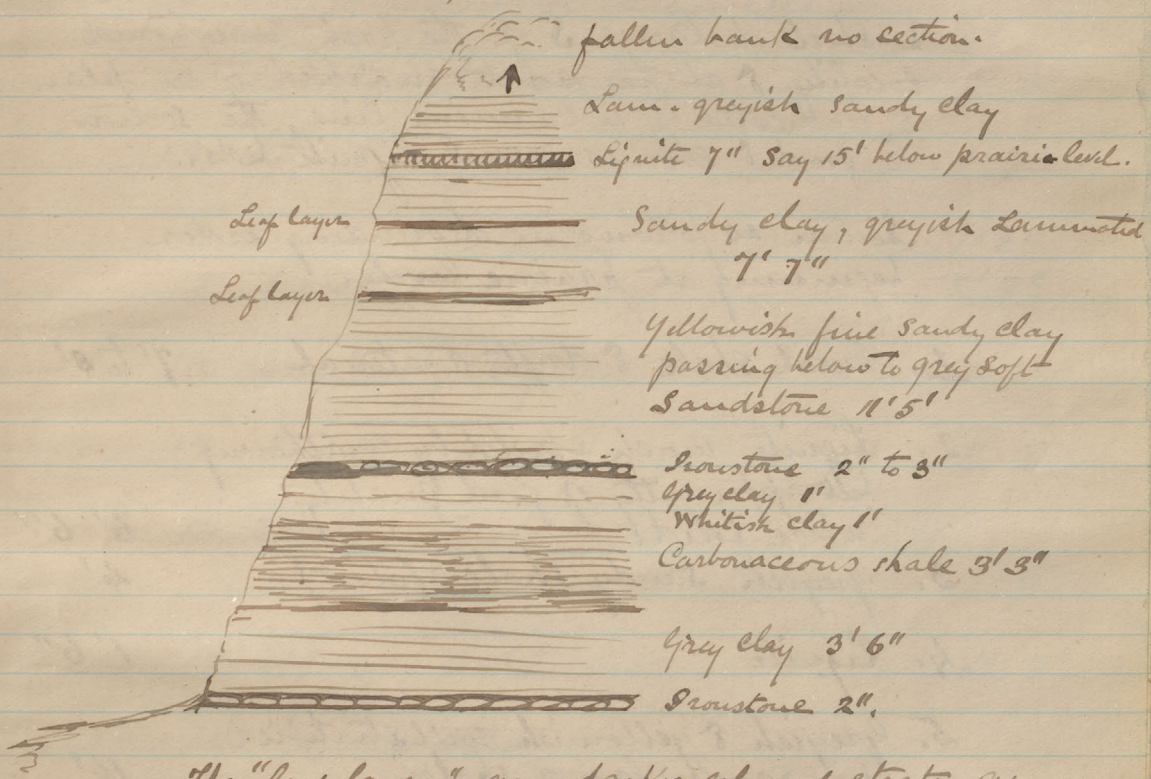
A short distance S of the first mentioned locality & at the point marked E on plan & indicated by a carmine line, the section is good & shows several lignite beds.

Section as follows in descending order beginning at prairie level.

1.	Mixed shale & drift material	7' to 8'
2.	Lignite much spoiled by weathering but apparently of good quality where solid.	6' 6"
3.	Greyish sandy shale (about)	4'
4.	Lignite	1' 6"
5.	Greyish & yellowish well stratified fine sandy clays or shales.	14'
6.	Ironstone (nodular)	2" to 4"
7.	Greyish & whitish clay	2'

Sept 18. Visited Cretaceous exposures at N.W. angle of W. Souris R. 6 miles from Wood End Depôt Camp.

Section at point (say ½ mile N of place) marked E on tracing of Col Forrest's plan.



The "leaf layers" are darker coloured strata among the rest a few inches thick & showing many impressions of parallel veined leaves like reeds but impossible to preserve on account of the crumbling nature of the matrix.
The ironstone layers nodular. Compact & grey on fresh fracture weathering bright brown-red.

the Soil. Implies ice of great thickness.
(Very coarse granite).

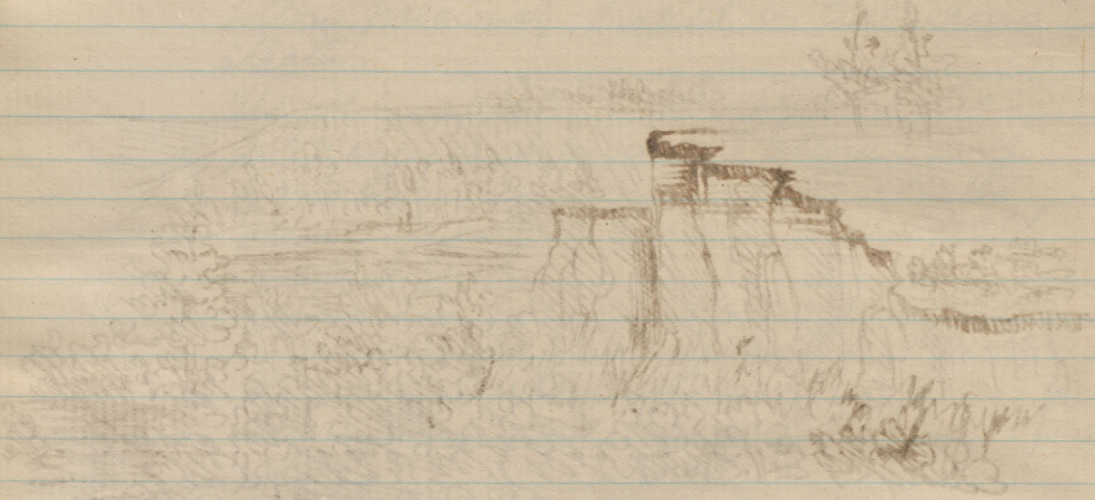
Sept 13. 73. boulders very numerous in some places along the trail W of first crossing of Souris. Mostly Laurentian a good many limestone, & beginning to appear some blackish & greenish greenstone & rocks more like Haroldian. Also observed today several blocks of pink sandstone with coloured stratification planes. Compact & moderately coarse grained. Also blocks of whitish hard sandstone.

darker

Sept 14. The sandstone boulders mentioned yesterday were more numerous.
Saw the first really well glaciated boulder today near the Depot Camp half way up the W bank of the Souris valley.

Little Nut shows prominently when viewed across the plain from the west & can be seen at least as far as the E. Souris. Slopes up gradually & really resembles the back of a turtle in shape. Little wood on Western slopes.
The Mountain appears to be the culmination of the hilly drift region E of it & forms its somewhat abrupt conclusion to the West.

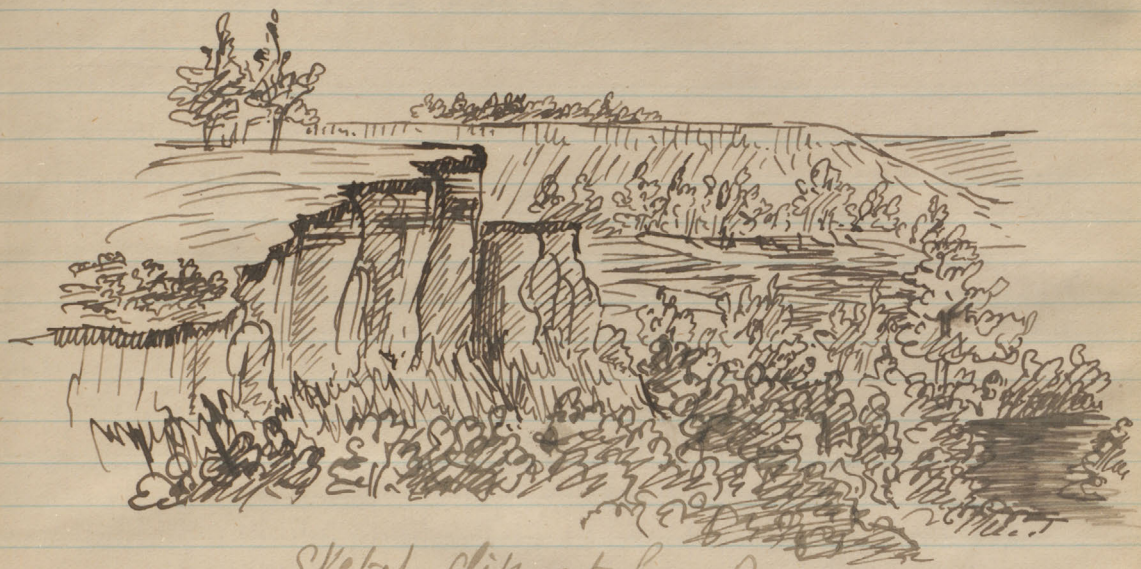
Seen from crossing of S. Antler Creek.



Sept. 8. Section in cliff at Badger creek showing 20' or 30' like drift section in East River, but not so well marked. Talus too old to show wher Cretaceous beds underlie or not.

Boulders, some of Carp serp, most of Laurentian but some of Limestone have been getting more & more abundant since leaving Sekakina R. & some valleys here are quite filled with them.

One at Long R measures about 10' square on top & sinks to an unknown depth in



Sketch cliff at Long R.

At the lower part of the cliff (below the beginning of the talus) Cretaceous beds similar to the upper series at Pembina R. Section appear. Also in several places along the river bank. Probable at least 20' above the river level of these cretaceous shales, then from 10 to 20 feet unrepresented & then the drift section already illustrated comes in.

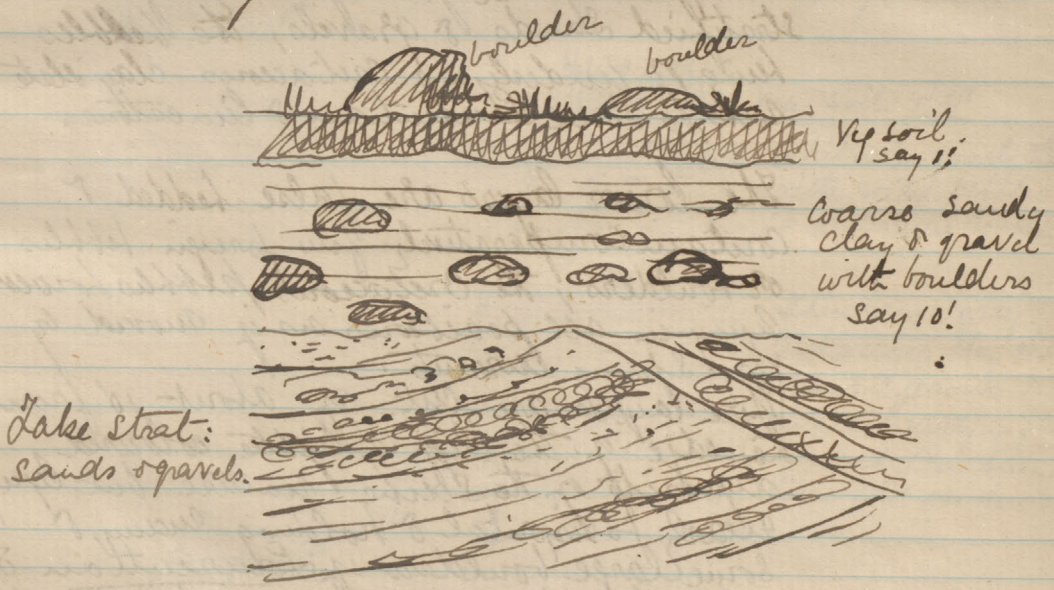
The valley of the Long R about 150' deep (aneroid) or half the depth of Pembina R. The valley will also be about half the width.

Found specimens with fragments of inoceramus or of some cephalopod shell.

Strong currents in shallow water of a hollow previously eroded in cretaceous strata.

The filling appears to have begun before submergence, sufficient to allow ice of great carrying power to pass over the place. The pebbles therefore principally small & local.

Icebergs then appear to have begun action by planing the strata smooth & depositing the debris, together with boulders from the Laurentian axis, horizontally upon these edges.



The upper horizontal layers here evidently the same as that portion of section in last Coulé.

lie quite horizontal & if so the thickness of the overlying beds at Pembina R. must approach 200'.

Section at Long R.

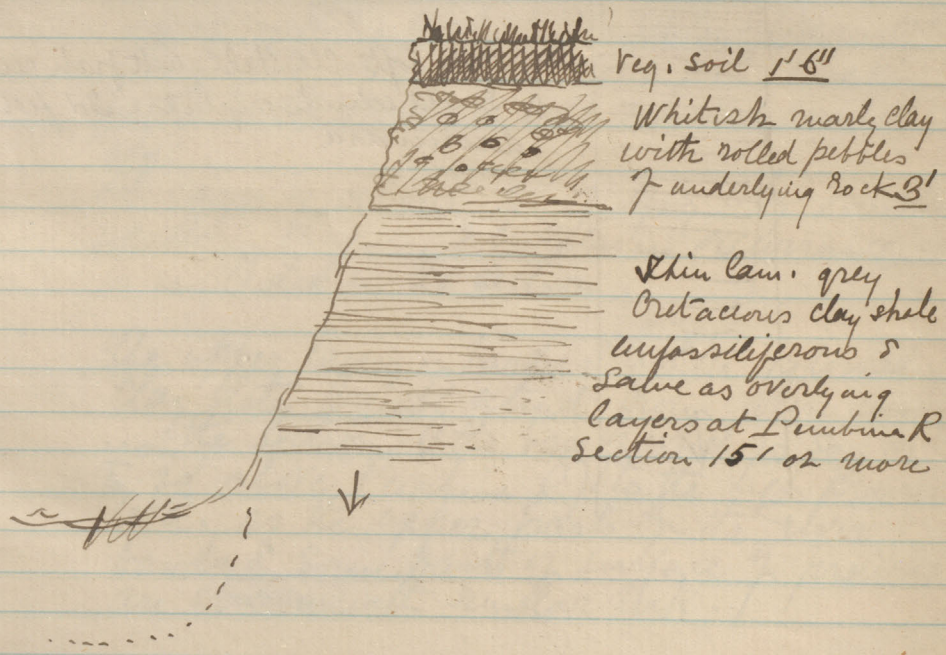
A Cliff of about 30' high with a steep sloping talus at the foot. The top of the cliff being say 15' below the average prairie level.

The cliff composed of irregular & false stratified sands & gravels, the pebbles being of underlying cretaceous clay slate rocks, & some Laurentian & limestone.

The lower layers are false bedded & contain comparatively few foreign pebbles or boulders, the cretaceous pebbles however lying in all positions as if moved by very strong currents.
These layers are cut off about 10' from the edge of the cliff by lighter coloured deposits of the same nature but lying nearly horizontal & holding many & some large boulders of Laurentian & white limestone, together with much small cretaceous stuff.
Have here evidently the filling caused by

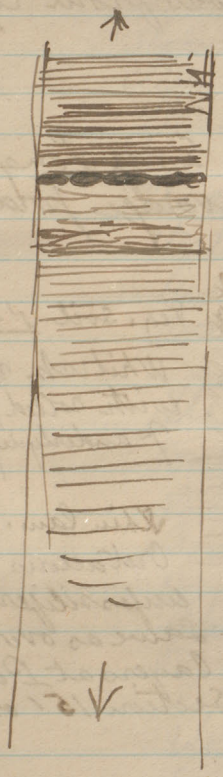
Sept. 7. Valley of the Pembina by Aneroid from Water to prairie level 360 feet.
The terrace which is of quite large superficial extent in places is 200 feet above the water.
Many boulders superficial on the upper prairie level.
The valley about a mile across from lip to lip.

Section in Coulé 3 miles E. of Long R.
The top say 20' below the average prairie level.



The strata here as at Pembina R appear to

The W side of Pembina R. Valley shows a well marked terrace about 2/3rd way up.
On this & on banks generally many boulders & some very large. Mostly Laurentian, but a good many limestone, some like the Gazey lime, & some compact, hard, & weathering pure white like that seen E of Dufferin. No undoubted Huronian blocks.



Thin grey clay shale 6' & upwards.

Ironstone nodules 2"

Rusty, schistic, decomp. clay shale 3'.

Blackish soft clay shale with fish remains & small schistic crystals 20' feet & downward

made search for organic remains.
The upper layers consist of thin laminated & finely fine clay slate of a grey-green colour & fold into possible undoubtedly some little branching rust-marks may indicate fucoids.
The next bed is rusty & decomposed with much gypsum in small stellar aggregations & separate crystals scattered through it.
Below this & going down as far as section blackish soft clay slate, apparently somewhat bituminous, & containing numerous remains of fish, though all in a crumbly & fragmentary state. The scales apparently belonged to ordinary ossious fish, & have for the most part a well marked combed edge.
with sys. cryst.
A layer of about 2" of grey clay-sandstone weathering brown, & nodular in occurrence is included in the section.

The upper layers of harder & lighter coloured clay slate probably extend from where seen in the section (the base of which is say 20' to 30' above Pembina R.) to the high prairie level. as the upper parts of the river banks & some parts of surface of prairie are strewn with similar rock.

Expedition Westward from Dufferin.

Sept 5, 73. In the Coulé by which the Commission trail ascends Lemhina, but a bare hill side formed of Cretaceous strata, but crumbled down & weathered in such a way as to show no good Geological section.
The rock a greenish-grey clay, a clay slate with no apparent organic remains, & at least one layer of ironstone concretions, 1" to 2" thick.
The clay bank must represent say at least 30' of strata, & the top is but much below the general level of the upper prairie.

Many boulders in the same coulé most Laurentian but some large limestone boulders, yellowish & resembling the Garry stone.

Sept. 6. The Lemhina R flows in a large & deep valley, the stream is small & pursues a very tortuous course in the generally flat bottom of the valley. There are picturesque lateral coulés of considerable size.
The valley is thinly timbered, but contains much bush & brush.
Found a high & steep bank of Cretaceous about a mile south of the crossing of the Commission trail. I got a section exposed &

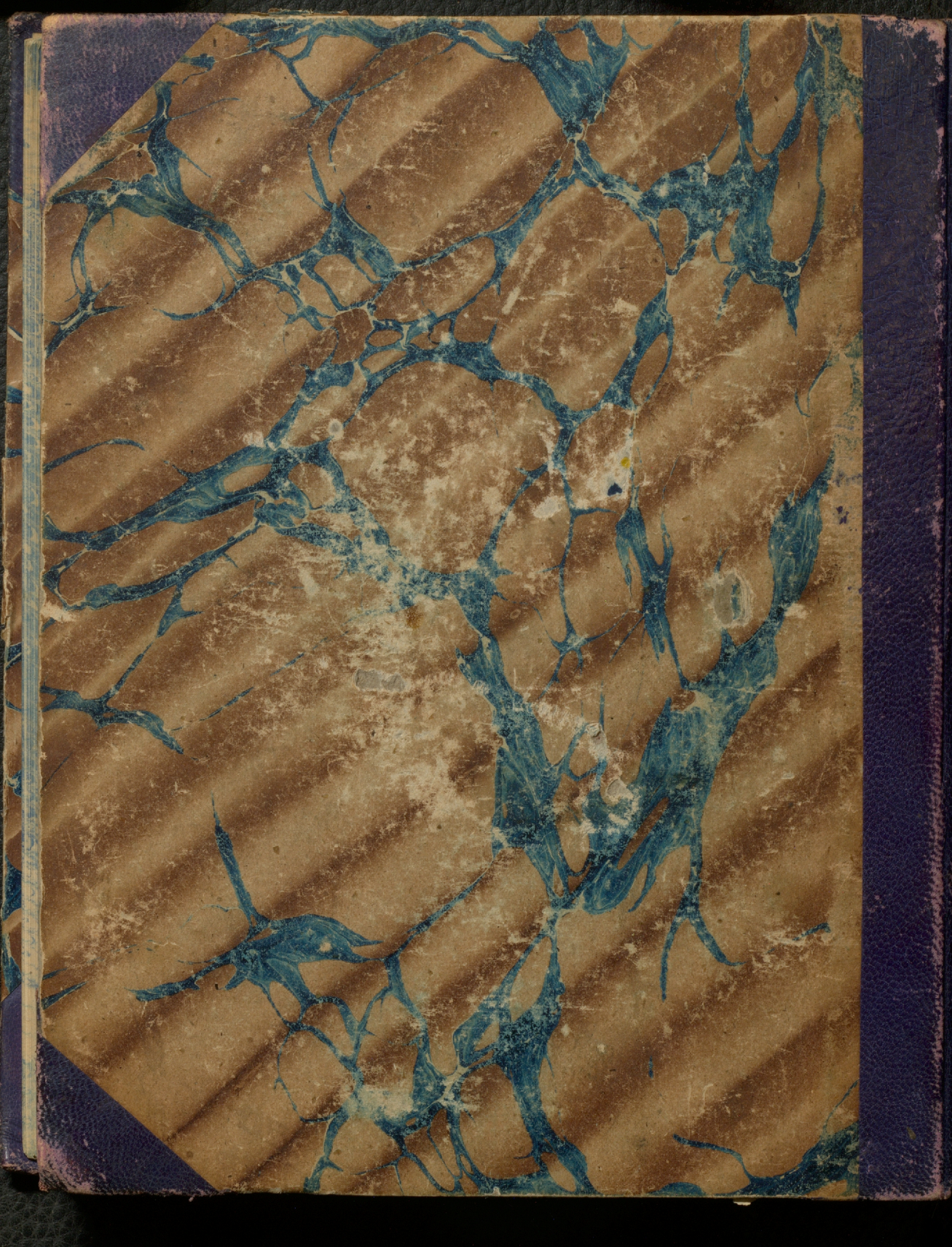
Geological Notes of

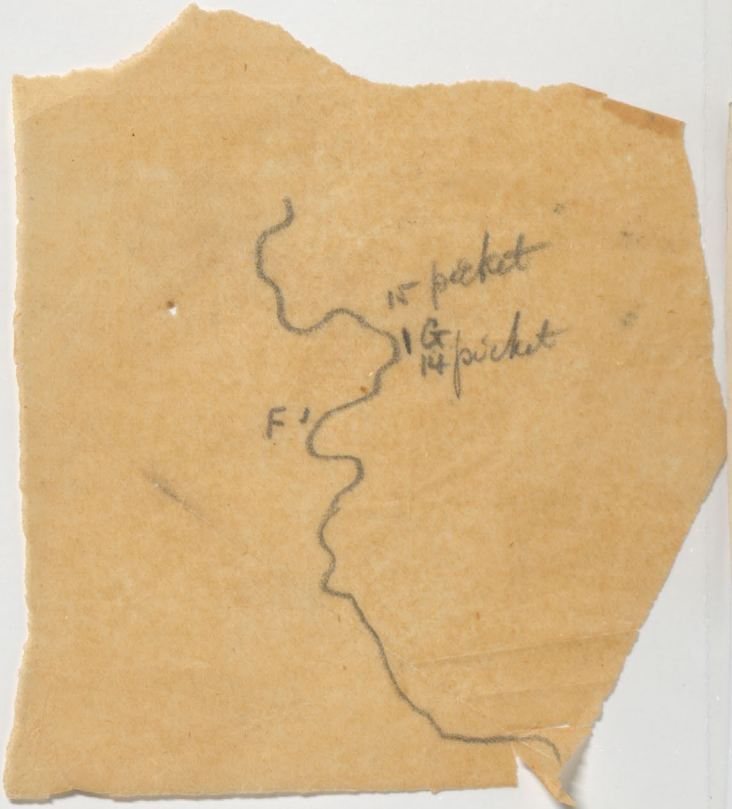
G M Dawson

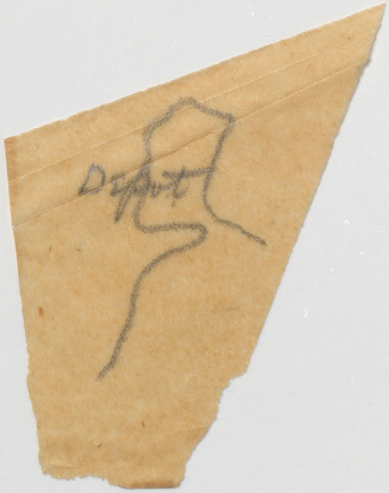
H McNabb.

Sept. 73.

Rocks in middle third
Pyramid Val. Sect.




15 picket
1 G
14 picket
F'


Depot


Rocks of middle third
Pyramid Val. Sect.

For Mr. Dawson
Note Enclosed

A. L. R.

$$(R+4)^2 = R^2 + 179^2$$

$$R^2 + 8R + 16 = R^2 + 32041$$

$$8R = 2025$$

$$R = 4003$$

$$\begin{array}{r} 179 \\ \cdot 179 \\ \hline 1611 \\ 1253 \\ 179 \\ \hline 32041 \end{array}$$

Point F on map - fossiliferous limestone in broken pieces & small rather poor lignite exposure close to top of bank.

Point G - West of Survey Stake 14 is very interesting. There is a good exposure here and in the stream a curious oblate spheroid sandstone boulder very symmetrical 3 ft. in longest diameter - → Specimen piece enclosed

Section at G.

	Prairie
40 ft	Sand
2½ ft.	iron stone
2 ft.	sand
1½ ft.	shells sand & clay
2½ ft.	coal (lignite)
10 ft.	Sand & clay
	River

Specimens enclosed

There is another good exposure 100 yds N. of here.

Point F on map. - Fossiliferous limestone in broken pieces & small rather poor lignite exposure close to top of bank.

Point G - West of Survey Stake 14 is very interesting. There is a good crossing here and in the stream a curious oblate spheroid sandstone concretion very symmetrical 3 ft. in longest diameter - → Specimen piece enclosed

Section at G.

40 ft	Prairie Sand
2½ ft.	iron stone
2 ft	sand
1½ ft.	shells sand & clay
2½ ft.	coal (lignite)
10 ft.	Sand & clay
	River

Specimens enclosed

There is another good exposure 100 yds N. of here.

stone
lignite

very
hard
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3 ft. in
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e.

4. Localities ~~known to~~ spoken of by the indians or others where "large bones" are reported to be imbedded in river banks &c.

5. Special interest would attach to the reported occurrence of Coal, lignite, or ores of any of the metals, also to deposits of peat likely to be of economic importance.

6. ~~Whenever~~ Wherever possible the skulls of any of the larger animals which may be killed should be preserved, also skulls which may be found naturally prepared by weathering.

7. The principal dimensions of the larger animals & birds might be taken immediately after death.

8. Authentic skulls, or other remains of the indian inhabitants of the country, or of their work. ~~are of interest~~ when found should be carefully preserved.

9. Note should be taken of any indigenous plants which may be used by the indians as food or

medicine, & where possible specimens should be preserved & the indian names ascertained.

10. Peculiar insects may be preserved by immersion in a wide mouthed phial containing a little alcohol. Notes concerning these, & especially any information bearing on the life-history & extent of the ravages of the locusts & grasshoppers may prove to be of practical importance.

George M. Dawson

Memo. on
Collecting & Observing

Copy. June 9. 73.

To the Chief Astronomer

It is requested that any objects of interest as illustrating the Zoology or Botany of the country traversed by the various parties of the B.N.A. Boundary Commission, be preserved, if possible, & forwarded to the Naturalist at the first convenient opportunity. Also that note be taken of such localities as may offer assistance in working out the geological structure of the country, & may be worthy of a visit in that regard.

~~The points of special interest are.~~

As points of special interest may be mentioned

1. Exposures of rock in place, in river banks or coulés, or of clay banks exhibiting good sections illustrative of the substructure of the prairie country.

2 Boulders of remarkable size, or remarkable collections of boulders.

3. Salt or alkaline springs, or copious springs of fresh water.

Besides geological specimens & samples of ligneous rocks, soil, &c. a large collection of plants has been formed. In Zoology I have made such collections as compatible with other duties, & with Sapper Deadworth's assistance a good Representative collection of birds has been got together.

Previous to the recpt of your telegram directing me to proceed to Montreal which Capt Ward has shown me, I had ~~made~~ with Capt Anderson's concurrence made arrangements for returning to Canada for the purpose of working over & arranging the specimens, & writing reports up to date, & ~~now only wait a chance of transport to Moosehead.~~ I have been waiting some days for a chance of transport to Moosehead, & now hope to leave on Monday

With your concurrence I would propose making some alterations in the travelling equipment of my ~~department~~ party for the coming season.

During the past summer I have employed two Red River carts & ponies, together with a saddle horse.

The carts I find ~~exceedingly~~ unreliable & subject to accident, besides which they do not afford efficient shelter to collections during wet weather, & tend to injure such instruments as may have to be carried in them.

For the coming season I would therefore propose to substitute one covered Whitewater waggon with a pair of horses. ~~Together with~~ ~~Also~~ and a buck-board for my own use, with a box fixed behind the seat for specimens ~~collected~~ &c.

With this outfit ~~I would~~ the two pack-saddles which were allotted to me this spring, but which I have not yet had occasion to use ~~would enable me~~ it would be possible to travel to advantage as long as any trail existed, & making use of a Depôt or large party as a base of supplies, make flying excursions through rough country such as may be supposed to exist toward the base of the Rocky Mountains.

I have ordered powder, shot, preservatives &c for next year through the Department here. A few other articles which require to be obtained or replaced I shall attend to myself while in Montreal.

14
10
24
48

Hight of water in Red River in April 1874. From Mr Fisk's observations.

April 14 water stands today 6" above winter level.

April 15.	rise	1' 5"
16.	"	0' 9"
17.	"	0' 7"
18.	"	0' 9"
19.	"	0' 10"
20.	"	0' 11"
21.	"	1' 2½"
22.	"	1' 10"
23.	"	1' 6"
24.	"	3' 3"
25	"	3' 3"
26	"	2' 3"
27	Fall	0' 6"
28	"	0' 9"
29	"	0' 4"
30	"	0' 10"

Compare with temp of water & holes on break up of ice &c in diary.

Note on Rise & fall of Floodwater in Red R. April 74.

Rise of water in Red River April & May 1873.

April	10	0'. 8"	
	11	0. 9	
	12	1. 3	
	13	1. 8	
	14	2. 0	
	15	1. 7	
	16	1. 9	
	17	2. 1	
	18	1. 7	Ice began to move
	19	2. 5	
	20	2. 1	
	21	2. 3	
	22	2. 0	
	23	1. 9	
	24	1. 3	
	25	1. 9½	
	26	1. 0	
	27	1"	
	28	5	River Clear.
	~~28~~ 29	3	
	~~29~~ 30	5	
	~~30~~		
May	1	0. 7½"	
	2	7	
	3	6	
	4	5	
	5	4	
	6	3	
	7	1	

Total rise 31' 10"

Max: height on May 11. 31' 11" above winter level

Floor of Quarters 7 ft 5½ inches above highest water.

Line of water in the River. April 9 Noon 1873.

April			
	10	0' 8"	
	11	0. 9	
	12	1. 3	
	13	1. 8	
	14	2. 0	
	15	1. 7	
	16	1. 4	
	17	2. 1	
	18	1. 7	Ice began to move
	19	2. 5	
	20	2. 1	
	21	2. 3	
	22	2. 0	
	23	1. 9	
	24	1. 3	
	25	1. 0½	
	26	1. 0	
	27	1"	
	28	5-	River Clear.
	29	3	
	30	2	
May	1	0. 7½"	
	2	7	
	3	6	
	4	5	
	5	4	
	6	3	
	7	1	

Total rise 8' 10"

Max: height on May 11. 3' 11" above mean level

Flow of Juniata 7th. 5½ miles above Tuckset water.

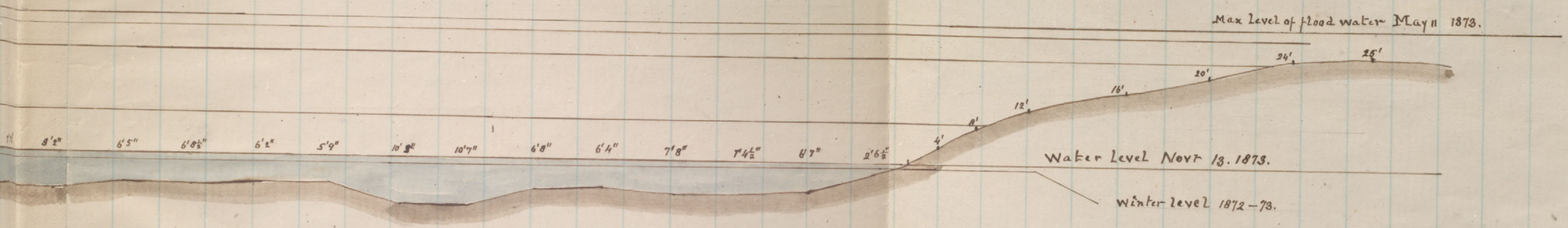
After completing as far as possible, the examination of the Southern part of Lake of Woods, I made a rapid trip through the Northern part, known as Clear Water Lake, & to Rat Portage at the outflow of the Winnipeg R. This expedition was productive of much geological information, & established the fact of the existence of a great area of Huronian rocks consisting of dark colored schists & ~~[illegible]~~ rocks which form a close junction with the Laurentian Gneisses rocks at Rat Portage.

Immediately on returning to the N.W. Angle I made arrangements for proceeding to Dufferin via Red & Roseau Rivers, taking for this purpose a single three fathom Canoe & two men. ~~This trip was accomplished in 11 days~~ The trip occupied 16 days & though furnishing ~~considerable~~ some information of interest with regard to the country, did not, as I had hoped it might, yield any exposures of Silurian or Devonian rocks.

Having spent – days at Dufferin arranging specimens & making the necessary preparations I set out on the journey Westward along the line on Sept –. & succeeded in reaching within a few miles of the 400 mile point. The time devoted to the exploration of this great stretch of country was necessarily small, & I was prevented from making several branch expeditions which I had contemplated, ~~on the way in~~; by the unusually early closing in of winter.

The existence however, has been proved, of a great formation apparently of Tertiary age which first appears about the – m point & seems to overlie the beds of Cretaceous age seen further East. This formation is rich in Lignite of apparently good quality – almost every section exhibiting seams of ~~greater~~ more or less ~~thickness~~ importance; It is in all probability a portion of the great Miocene Lignite basin of the Missouri.

Goes as far was known.

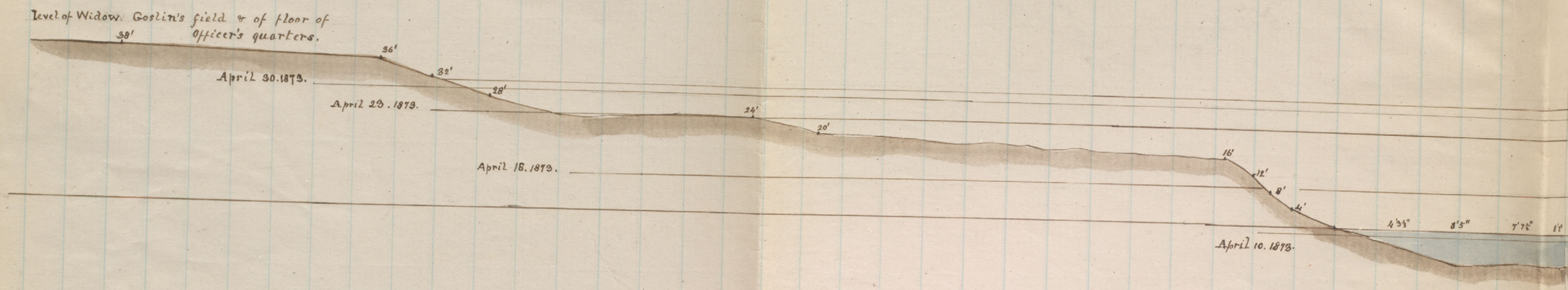


Scale 30 ft to one inch.

Average depth of river 6'11"

Discharge 97'920 Cubic ft per minute.

[Current estimated at mean of 2 miles per hour.]



Section of Red River opposite Dufferin