

Junius Henderson
Field Notebook
No. 2
1907-1908

Jessie Henderson
Boulder, Colorado

Field Note Book

No. 2

1907-1908

EGGERS-O'FLYNG CO.

(OMAHA PAPER BOX CO.)

PAPER CIGAR FOLDING BOXES

PHONE DOUG. 1139. OMAHA

1908	Sun.	Mon.	Tue.	Wed.	Thurs.	Fri.	Sat.	1908	Sun.	Mon.	Tue.	Wed.	Thurs.	Fri.	Sat.
Jan.	1	2	3	4	5	6	7	July	1	2	3	4	5	6	7
	8	9	10	11	12	13	14		8	9	10	11	12	13	14
	15	16	17	18	19	20	21	Aug.	15	16	17	18	19	20	21
	22	23	24	25	26	27	28		22	23	24	25	26	27	28
Feb.	29	30	31	...	...	...	...	Sep.	29	30	...	...	...	...	...
	1	2	3	4	5	6	7		6	7	8	9	10	11	12
	8	9	10	11	12	13	14		13	14	15	16	17	18	19
	15	16	17	18	19	20	21	Oct.	20	21	22	23	24	25	26
	22	23	24	25	26	27	28		27	28	29	30	...	...	...
	29	30	31	...	...	...	...		4	5	6	7	8	9	10
Mar.	1	2	3	4	5	6	7		11	12	13	14	15	16	17
	8	9	10	11	12	13	14		18	19	20	21	22	23	24
	15	16	17	18	19	20	21	Nov.	25	26	27	28	29	30	31
	22	23	24	25	26	27	28		1	2	3	4	5	6	7
	29	30	31	...	...	...	...		8	9	10	11	12	13	14
Apr.	1	2	3	4	5	6	7		15	16	17	18	19	20	21
	8	9	10	11	12	13	14		22	23	24	25	26	27	28
	15	16	17	18	19	20	21	Dec.	29	30	...	...	...	...	...
	22	23	24	25	26	27	28		6	7	8	9	10	11	12
	29	30	31	...	...	...	...		13	14	15	16	17	18	19
May	1	2	3	4	5	6	7		20	21	22	23	24	25	26
	8	9	10	11	12	13	14		27	28	29	30	...	...	...
	15	16	17	18	19	20	21								
	22	23	24	25	26	27	28								
June	29	30	...	...	...	...	...			

Ft. Collins Trip.

May 24, 1907

Left Boulder on 9:25 train, No 99
morning, clouding up at train time
with east wind. Train left Boulder 10 min
late. Rode to Longmont in seat with Capt. McSwain.
Arrived at Ft. Collins at 11:32 - 7 min late.
Went to Northern Hotel, washed up & at
12:11 - went in to dinner. In afternoon
I went to the agriculture College, visited
Prof. Long in Physics laboratory, who
showed me about the buildings, also
had a visit with Mr. Bragg in the
museum, arranged with a student to
accompany me tomorrow. Then went
to The Mountain Avenue Co.'s Stable at
12:57 E. Mountain ave. and arranged for a
train for tomorrow, reaching hotel again
at 5:15.

H. Collins, Col. May 28/08

Rained last night, cool and somewhat cloudy

this morning. Had breakfast at 6:30 a.m.

Started at 7:10 with C. G. Rabeck. A cold
rain and fierce wind was blowing striking
us to the bone despite "slickers" and heavy
lap robe. We drove through La Porte, thence
to Forks, where we took the right hand
road, leaving Livermore to the left, and
went about 4 miles further. This quite
evident that the foothill geology will be much
more difficult to work out than further
south, as there is much folding, which
gives to the formations outcrops very
irregular outlines and the folds and general
flatness of the dip spreads the formations
out over a wide and decidedly variable
zone, extending them into the foothills
long distances in several places. We
fed the team ^{at noon} at a point about 9 or 10
miles south of the Wyoming line, then
turned back at 2 p.m. and drove by

way of ~~Bellevue~~ Bellevue, where we
found a beautiful anticlinal fold which
can be nicely photographed, in the
~~Lystus~~
formation. Reached the hotel
at about 5:30, chilled through and
very tired. Retired at 8:15.

Fr. Collins, May 25, 1902

Cloudy morning, but calm. Arose at
7:15 intending to remain until 2 p. m., but
concluded to take the 8 o'clock train, so
left without breakfast. A little fresh snow
on top of the highest foothills, probably about
the altitude of Green Mt. at Boulder.

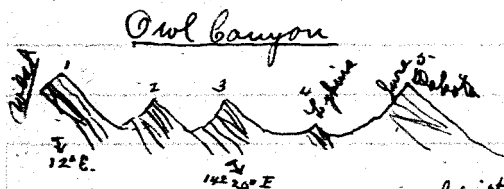
Trip to Northern Colorado

Thursday June 6, 1907

Almost perfectly clear morning at Boulder about 50 prairie jays flew over the house at 7 a.m. going nearly north. Clouded up before 9 a.m. Left Boulder at 9:40 for Ft. Collins by C. & N. Ry, arriving there at 11:40. Got outfit from freight depot and then went to Tideman Hotel for dinner. Got loaded by 2 p.m. and started at 2:20 in a driving rain. Dadds & I in the saddle, Rawaley, Robbins & the driver (Casey) in the wagon, the outfit from Tate & Sedgely's stable. Dadds and I went due west and photographed the fine fold ~~south of Fort~~ at Bellevue, catching the wagon at Owl Canyon at 6:30, where we went into camp. Saw following birds: magpie, Redwing blackbird, Lark bunting, Arkansas kingbird, ^{T.H.} kingbird, Mourning doves, 1 killdeer, 1 sunfisher, Robins, Barnswallows, ~~South~~ ^{chiff} swallows.

Meadowlark, Burrowing owl, goldfinch
Crewer blackbirds. Several birds singing
about camp whose songs I do not recognize.
Retired at 9 P.M.

Friday June 7, 1907



Ridge 2 strongly crossbedded, ^{at top, took picture} found aragonite crystals
at base of 3 is a strong ^{gypsum bed} ~~shale~~ which has
been quarried but ~~weathered too rapidly to be~~
~~of value except for lime purposes.~~

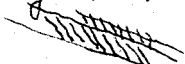
Arose at 4:30 a.m. Found cliff swallows
busy building nests where Owl Creek cuts
through ridge No. 1. Nests a little further
all finished. We collected mollusca and
plants where stream cuts through Ridge
No. 2 + started on at 9 a.m.

At ranch on section line

N. W. of

Owl canyon found Fountain conglomerate dipping

about 15° nearly E. strike about N. strongly crossbedded, thus



Reddish and

gray, coarse sand and pebbles up to one inch, just S. of ranch house. The exposure to the west between the first and the sharp rise of the micaceous granite hills were arkose, with 2 or 3 inch pebbles toward the base and no crossbedding so far as I discovered in the few moment stop.

Has scarcely a tendency toward isolation from granite into a high ridge as at Boulder.

* E. of Forbes Hotel strike changes to $N. 120^{\circ} W.$

and dip is about $N. 75^{\circ} W.$ dipping about 18° . The strata swing well west or S.W. then back a mile or so north, so that a cross section (generalized) E. of road from Forbes Hotel northwestward is about thus. Looking West:

Forbes ^{S.W.}



at N. end of section granite swings across road well to the east. Camped on Ten Mile Creek at 12:20 for lunch. Resumed our journey at 1:30 p.m., Ransley & Saddle in the saddle, after we left

the Laraine road we crossed
Fountain formation, but soon got to
granite, which continued across South
Box Elder to North Box Elder. We
camped below Box Elder ^{P.O.} a mile or
two. The granite weathers into "roadstods"
at Box Elder, owing to ^{horizontal} resistant zones.
We

+

North Box Elder,

Saturday June 8, 1807

Rained for a little while after breakfast,
and was gloomy. I was the last one up, arising
when breakfast was nearly ready, at 7 a.m.
there were indications of clearing up, so
Dadd and I started horseback, crossing over
to the "Dakota" ridge. Found the "red beds" generally
dipping strongly to the eastward and in places
folded more or less. The Lykins? was also
folded and considerably crushed in places.
In the Jurassic Dadd found some baryta.
The "Dakota" exposure consisted entirely
of a coarse conglomerate of sand, gravel

and igneous boulders up to a foot in diameter with a calcareous cement as shown by its effervescence in acids at least in the upper part

It was in all perhaps 100 feet in thickness. The upper part reminded me of the "mesa caps" in places north of Boulder where cemented by a calcareous matrix. Passed northward into Wyoming, thence westward passing around the head of Sand Creek and its tributaries except one, which we crossed, thence southward to Box Elder P. O. over the Cheyenne road and on to camp. Found nothing suggesting the limestone containing carboniferous fossils mentioned by Darton et al. unless at northwest corner of the quadrangular course of the days travel. Saw about 75 pinon jays flying nearly north. Had a very hard day. It hailed at about 10 a.m., immense hailstones falling, with very little rain, so that we kept moderately dry, lying under a low cedar which broke the fall of the hailstones. at 2 p.m. it began to hail and rain furiously & kept it up until we reached camp at 3:15. soaked through and chilled, the ground

white with hail. The sun then came out, but it clouded again at 4:30. Among the most common birds at this camp is the Brewer blackbird. List is as follows: Blue swallow, violet green swallow, mt. bluebird, Buzzard, Red tailed hawk, Brewer blackbird, cat bird, *goldfinch & red head woodpecker, cowbird, white throat swift, yellow warbler, *flicker, robins, red wing, ^{summit solitaire} Rock wren, Dipper, Bullock oriole, blackbird (common), meadowlark, Killdeer, long crested jay, ^{hummingbird}, Lincoln song sparrow, prairie jay, towhee. Meadowlarks were also common on high plains near Wyoming line.

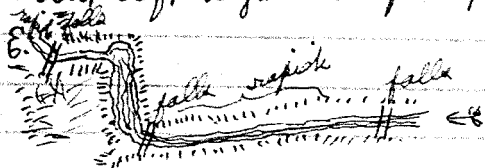
In evening Dadds & I collected *Pisidia* in the creek.

Box Elder Creek

Sunday June 9, 1907.

Cold, windy morning, clearing by 9 a.m. but west wind continuing. ~~Got~~ Arose at 6 a.m. Dadds & I collected *Pyramidula*, *Loricoides*, *Val-lonia*, *Pupalta* & *Pisidium* after breakfast, then shaved and started down stream at 10 a.m. Visited & photographed ^{the upper} ~~the~~ falls in the granite near where the creek reaches the sedimentaries, at the very edge of the granite.

a joint plane suddenly changes the course of the stream at right angles for 60 or 75 feet where it flows through vertical walls about 60 ft high and 10 feet apart, thus



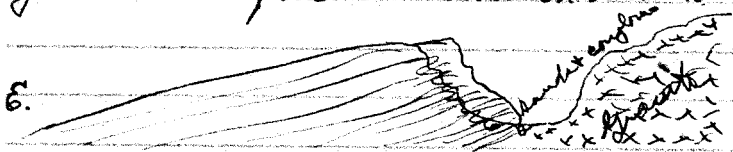
The last jump of the falls is sheer over a vertical 60 ft. wall formed by a joint plane in the granite just before leaving the granite. The granite lies on both sides of the lateral valley which cuts in from the north at the lower fall. In other words the lateral drainage cuts back into the granite as it does in the region of Boulder, instead of cutting along the contact or into the sedimentaries. This is likely due to the fact that the sedimentaries were laid on a surface of weathered granite. ^{No.} at any rate here the upper part of the granite is weathered, while lower it is unaffected. If the granite were unweathered there seems no good reason why the cutting should not be in the sedimentaries, as they are not particularly resistant, so

far as chemical and physical conditions. At least there are soft strata and much rock with soft calcareous cement.

In afternoon we went over to South Boy Elder and followed it down to junction with the north branch. Its lower course is very steep through granite, with gneiss about 200 or 300 ft back from the edge of the granite. The north branch runs south from the falls between the granite and the sedimentaries and just below the confluence the combined drainage ~~turns eastward and~~ breaks through the sedimentaries. Immediately above the confluence we found an exposure of ^{75'} ~~75'~~ or more of coarse sandstones and conglomerates, varying from dark red to pure white, ~~conspicuous~~ ^{effervescing freely with acid}, and extending to the creek bed. ~~The nearest exposure just~~
~~across the creek is granite.~~ ^{No.} The granitic cliffs west of the creek are high & steep, from which one may infer the ancient sea wall from which the pebbles were derived, were it not that no large boulders were observed in the ~~granite~~ conglomerate. The sedimentaries indicate uplift by their eastward dip, which

would undoubtedly involve the granite.
Following is a generalized section showing
their present relations:

E. + W. section across North Box Elder Creek
just above confluence with South branch.



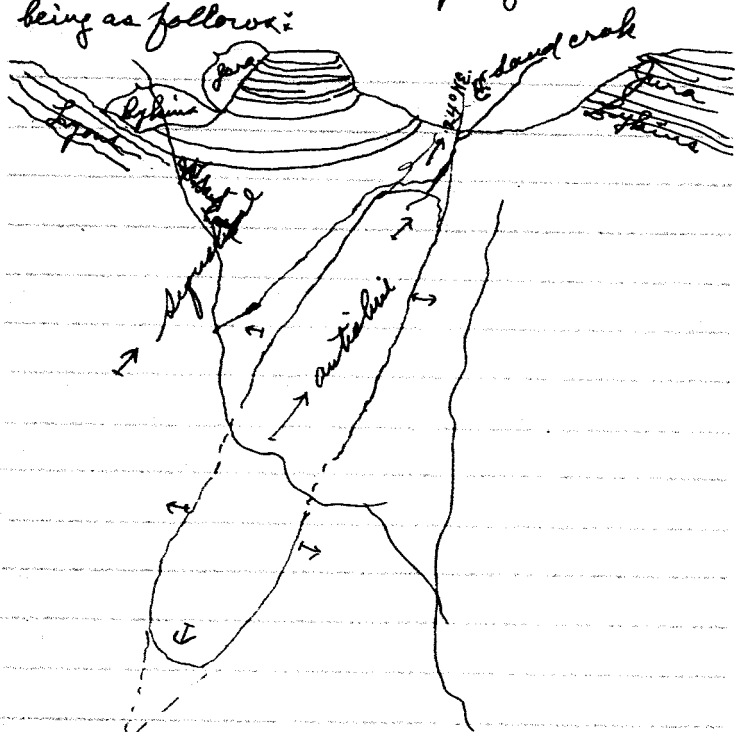
The conglomerate where so well exposed is
very friable and not calcareous, but a
slight exposure just below the confluence effe-
rences freely in acid. The conglomerate is much
thicker than we supposed, as we discovered a
little later, with a harder band a little
above the exposure just mentioned, then softer
above. It answers to the Fountain formation at
Boulder except that the cement is weak aside
from the one stratum just mentioned, so
that it is covered by debris of the talus slope.
above this are the sandstones, limestones, etc.,
which are equivalent to the Lyons formation at
Boulder, a resistant sandstone at the top forming
an escarpment on the west and sloping away
more gently to the east.

~~South~~ ^{North} Bay Elder Creek

Monday June 10, 1907.

Strong west wind but warmer than yesterday. Loda & I started for Sand Creek at 8 a.m. finding a much easier trail over the high Lyons ridge and down to the creek. The east slope of the Lyons escarpment is approximately ^{the same as the dip of the} the contact between the Lyons & Lykins formations, the latter lying apparently ~~at~~ conformably on the former toward the base of the slope, having been eroded from the upper part of the slope. Sand Creek is nearly dry and the flat sandy bottom about 200 yards wide where we entered it. An elongated (N. & S.) hill through which Sand Creek cuts about E. of our camp is an anticlinal fold in the Lyons formation the west limb dipping very abruptly and the east ~~slope~~ limb approximately the normal dip for the region. An E. & W. fold in the same formation occurs about a mile N. & W. of this. North of this hill the entire valley

is over 2 miles wide and the anticline & syncline both show beautifully the section being as follows:



B. Sand Creek cuts through a trough from N. 24° E. through N. end of anticline then swings over into syncline and cuts through it to junction with W. sand creek, then both swing E. through anticline. The cliff on S. side sand creek seems surely Lyonne formation. Section as follows:

thickness estimated

- 1 sandstone nearly white 10 ft weathered massive
2 very hard fine, pearl gray 6 ft massive
3 Pink thin bedded sandstone partly crossbedded weathered red 30 ft?
4 very fine grained calcareous sandstone, massive red 30 ft?
5 Pink sandstone, thin bedded, weathered red 10-15 ft
6 very fine grained massive sandstone white 9 ft
7 apparently dip flatter in actual face of cliff because exposure short.

We measured one face of 20 ft. & from that estimated whole cliff at 100 ft.

Big hill north of fold, in syncline is Lykins at base, dark red and regularly bedded below, ^{lighter red and massive} light pink and very massive in the upper ^{part} 50 ft which forms a bluff. red & pink relative part about 150-175 ft in thickness above this are about 200 ft. of light colored (mostly gray) limestones, sandstone & clay shale ^{of maximum} above this the slope to the top is covered by Dakota sandstone & conglomerate debris, none in place. Below this exposure we find the red sandstone to the Lyons ridge except for one white band about 20 feet thick everywhere present. Saw 2 white throated swifts on above mentioned hill. On way back we roughly estimated that there ^{is} ~~are~~ about 200 feet of Lykins below the

white zone and about the same above. The white zone itself, including an intermediate reddish zone is 50 ft. or more in thickness. The upper member of the Lyons is eroded back from the edge to make a low ridge and the Lyons still further back, in each case the dip of strata forming the surface of the hill. Erosion appears to proceed almost wholly at the edges except where drainage breaks through. Wind quieted down very much & it was warm in afternoon.

North Box Elder,

Tuesday, June 11, 1907

East wind this morning, perfectly clear & hot. Dadda & I started N. along the Fountain granite contact. In the gulch coming in from the N. to N. Box Elder Creek from the N. we found the drainage line to be practically on the contact in some places. S. of the ranch about a mile N. of Box Elder falls in the lateral N. & S. valley is a strong outcrop of Fountain

conglomerate out in the valley, while up the slope on very close to the granite is an outcrop of ^{thin bedded} reddish rock, partly fine grained & partly coarse sandstone, all of the latter outcrop effervescing freely. ^(This we have not found elsewhere.) Between the two is an outcrop of chert containing brachiopods of Palozoic type, which we were able to trace to where the valley turns westward in Wyoming, but found no more of the underlying calcareous rock, but did find the fountain. At the westward turn of the valley near head of creek in Wyoming we found a strong outcrop of Fountain, with ~~600~~⁶⁰⁰ ft. of hard gray limestone overlying it, containing numerous fragments of crinoid stems and a few poorly preserved brachiopods. It passed, apparently conformably, beneath the red, thin bedded Lyons sandstone, ^(this may be limestone, see tomorrow's notes) continuing thus northward as far as we could see. We traced the limestone nearly to the Box Elder & reached camp at 6 p.m. with a good load. Saw a night hawk in Wyoming. Jackson & Crawford arrived & camped at Box Elder P. O. Saddle & I called in the evening & discussed plans.

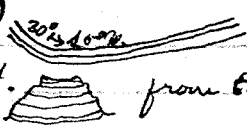
North Box Elder camp

Wednesday, ^{June} 12, 1907

Sodds, Crawford Jackson & I started down ^{N.} Box Elder in morning. Found the crinoidal limestone just below N. Box Elder falls well up on ~~the~~ slope of Lyons escarpment in form of boulders and in one ledge in place, where Sodds & Jackson obtained one brachiopod. It has more of a reddish tinge than further north.

Just below junction of N. & S. Box Elder is a strong ledge of the limestone resting on typical Fountain conglomerate, with about 20 ft. of Fountain above the limestone. Above the 20 ft. zone of Fountain ~~is~~ the thinner bedded, finer grained Lyons sandstones, limestones, etc. The thickness of the Fountain is difficult to ascertain, but we found it extending to the bed of the creek with but a narrow zone of debris intervening between it and the granite. There is not less than 200 feet of the Lyons

here and probably considerably more. About a mile S. of Box Elder is a formation resting on granite, which looks as if it were metamorphosed Fountain, but ~~the~~ contains no pebbles + no large feldspar crystals. It is full of mica, thin bedded dipping to N. 24° E. ~~soft~~ I believe it is weathered schistose granite. Continuing southward we found it frequently above the hard unweathered granite. At the ranch above mentioned I found ~~Lopus~~ ^{Fountain} conglomerate resting on granite and at the very contact, with an east slope, found a piece of chert containing brachiopods. Further south on the east side of the valley, up on the escarpment, we found the crinoidal limestone in Fountain conglomerate, with several other limestones of similar character above, alternating with conglomerate and sandstone, just as we found it in Wyoming. The thin bedded formation mentioned in yesterday's notes as overlying the crinoidal limestone may be a limestone, as a similar zone here is. We have not found any other outcrop of the limestone beneath

the chert at the ranch N.E. of camp, where the strike turns westward. I found a nonfossiliferous limestone in the Fountain limestone and in a higher horizon found the crinoidal limestone. Strike N. 36° E. forming a syncline next to the foothills with axis approximately E., N. limb steep, ^{dip} about 30° to bearing S. 5° W. Dip of S. limb very gentle. Red Mt. occupies base of syncline. Section E. of Red Mt. where strike changes to West N.  Section through Red Mt. from E.

Where road swings around west of Red Mt. in a ~~deep~~ valley, following the creek, to the N. 20° S. the sedimentaries have been removed unless it be the base of the Fountain, leaving a gently sloping plain, sloping from the west to the creek bed.

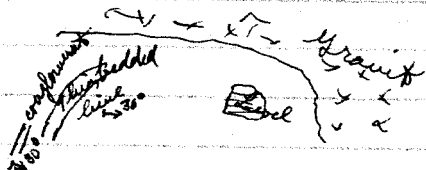
We have now traced the chert horizon near base of Sedimentaries from Wyoming to the place where the strike turns westward toward Red Mt., finding the brachiopods frequently most of the way. Also traced the lower

crinoidal limestone to same point, but
found no brachiopods in it after leaving
the Box Elder. Saw 2 buzzards and
1 red tailed hawk at junction of N. & S. Box
Elder.

Red Mt. Thursday June ~~24~~²³/₀₇

Dodge & I started on horseback N.W. from
camp on Ten Mile Creek just S. of Red Mt. to
examine the plain to the W. N.W. & S.W. which
appears to be approximately the ancient
sea floor, from which most of the
sedimentaries have been eroded. On the
divide between Ten Mile & Lone Tree Creeks
N.W. of Red Mt. we measured dip of Fountain
conglomerate & found it 6 deg. bearing N. 30° E.
The conglomerate covers a considerable
portion of the plain. ~~at~~ $\frac{1}{4}$ mi. further N.
dip is 6° S. 73° W., a valley occupying the
syncline here, the sea fence passing through
the valley. It is probably the Red Mt.
syncline. 300 yds further N. of last mentioned
outcrop is an outcrop of thin bedded limestone
resting on Fountain conglomerate & bearing

N. 25° E. The dip is about 30° bearing E., but blocks are tilted in every direction. To the east I failed to find a corresponding dip from the granite westward to form the east end of limb of the syncline. The relations are about thus:



N.S.W. is a white quartz blowout on a high hill on E. side Deadman Creek. It bears N. 29° W. from Red Mt. & S. 25° E. of Virginia Dale Mt. The Quartz continued S. W. as an interrupted ridge & also occurs on S. side of this plain, in each case not more than a mile or so into the granite.

About a mile S. of the first mentioned outcrop, the conglomerate dips 4° bearing S. 48° E. In that vicinity, as usual, the contact of Fountain and granite is occupied by a valley. Fountain approaches one quartz blowout very closely. S. 40° W. of Red Mt. is coarse conglomerate, with pebbles up to 4 inches in diameter lying

directly on an uneven eroded surface of rotten, deep red granite, contact showing for 100 ft., conglomerate dipping 10° bearing about E. The ~~center~~^{center of the} plain for some distance back is covered with ~~to~~ a thin remnant of Fountain conglomerate & thus showing approximately the ancient sea bottom. An other inlet of the Fountain, including the upper beds extends far west of Livermore. It is a syncline, at Livermore dip is only about 20° ^{to 40°} bearing N.E. Camped at Owl canyon at 6 p.m.

Owl canyon, Friday June 14/02

Lodds & I started up canyon on foot in morning & in narrow part, west of bridge, in limestone at top of nest to top limestone bench found brachiopods of barboiferous type. In a much lower horizon, near the ~~calcareous~~ where the limestones pass into calcareous sandstones & conglomerates we found crinoid stems, some strata composed almost largely of crinoid & shell fragments. The ~~any~~ limestones are of great thickness. Not far below the true

limestone is a conglomerate laid on an eroded surface. It is in a crushed zone, however, and the apparent nonconformity may be due to the crushing. Below the conglomerate just mentioned are red thin bedded slightly calcareous sandstone dipping 10° N. 63° E., which is in turn underlain by conglomerates unconformable on lower similar sandstones & then other conglomerates ~~the~~ all slightly calcareous in places.

section at Owl canyon reading from top to bottom reversed

Granite

covered zone 20 ft. perhaps ~~made~~ ^{weathered} granite as at bed Mt.

Very massive ^{hard} coarse conglomerate, crossbedded, dip 15° bearing N. 63° E. — 8 ft.

Same conglomerate appearing at intervals above debris for 200 yds to E. with much ~~weathered~~ ^{weathered} ~~rotten~~ ^{rotten} deep red conglomerate in upper 100 yds. of considerable thickness

covered zone of 200 yds or more, with ^{hard gray} 4 or 5 ft. of limestone about midway
Pinkish gray ^{calcareous} sandstone, rather thin bedded.

dip same as above, upper half ^{contains greenish} perhaps
may be called a ~~hard~~ limestone, all
moderately fine grained. ——— 25 ft

Very dark red coarse ^{rotten} sandstones & conglomerates
with patches leaching white ——— 15 ft

Mostly lighter colored, finer grained, harder and
thin bedded sandstone, some zones massive
& a little of the coarse dark red, 35 ft.

forming ~~and~~ ^{with} escarpment with the two
preceding numbers as the lower part
of the slope, on S. side of Owl canyon up
a lateral gulch of Owl canyon

Same as above, planed edges occupying the
gentle ~~on~~ E. slope of escarpment and
intervening valley between it & main
escarpment, estimated at 25 ft.

Massive pinkish limestone in bed of
creek & about 5 ft.

covered with intermediate massive conglom-
erates estimated 15 ft (in creek bottom

Soft, rotten reddish & whitish streaked, re-
markably crossbedded, coarse conglom-
erate with an intermediate thin bedded
red sandstone & some strong evidence
(obvious?)

above sandstone member, 44 ft.
Thin bedded, fine grained, hard sandstone
16 ft.

Left the section of the main escarpment to be finished by Dods, upon arrival of Crawford, Underhill & Jackson. We all visited the gypsum beds together & after lunch Crawford, Robbins & Dods continued measurements of the ^{Carboniferous} section, while Underhill, Jackson & I ~~was~~ examined the Chazy and Jurassic. After Underhill, Crawford & Jackson left at 4 p. m. Robbins & I went down to the Niobrara formation on horseback. Found the basal limestone not so massive as at Boulder, containing *Inoceramus deformis*, *Ostrea congesta* and an *Ostrea* and an *Inoceramus* new to me. It ~~was~~ ^{is} underlain by 3 or 4 ft. of sandstone, below which is the Benton shale. Above, the Niobrara divides here into two high ridges with a minor one and another still lower between. In the latter 3 are *O. congesta* on an unknown large

flat Diacranium as further south.

at camp the upper Lyone passes by transition from limestones + calcareous pink + gray sandstones through the pink Ten Sleep sandstone to the dark red Toiyabe shales, thence to the Jura.

Owl Canyon section completed by Soods.

Sandstone, calcareous, pinkish, more massive than below, crossbedded + near or limestone than sandstone at top, mostly covered with talus 40 ft.

Sandstone, red, medium to fine grained, calcareous, rather thin bedded, cross-bedded ————— 36 ft.

Friable ^{fine-grained} sandstones + shale, mostly red, 5 ft.
coarse sandstone ————— 1 ft.

Red sandstone, calcareous, rather thin bedded, with flagstone appearance — 1 1/2 ft.

Red sandy shale ————— 1 ft.
all above ^{3 or 4} variable

Sandstone, calcareous, red, fine grained partly massive or thick bedded + partly flaggy, some strata friable, some cross bedding, estimated 20 ft.

Sandstone, coarse, crossbedded, friable, dark red, varies in thickness + unconformable on surface below. 2 ft.

Sandstone, calcareous, banded red + white, very hard, fluggy, like Lyons ^{type} — 1 1/2 ft.

Shale, sandy, red, ferruginous, interbedded with lenticular bodies of gray limestone, becoming conglomerate at top — 6 ft.

Sandstone, pink, calcareous, coarse, laminated in color, not in ^{apparent} structure, but weathering into thin beds — 15 ft.

Sandstone, fine, massive, red or mottled 17 ft.

Limestone, gray, massive, ridge maker 6 ft, making lowest beach

Sandstone, red, thin bedded, cross bedded, upper part usually massive, estimated 30 ft. crinoidal

Limestone, gray, massive, very hard, strong ridge maker, first real ridge maker, containing brachiopods 15 ft

Sandstone, pink, medium grained, thin + cross bedded, like Lyons — 20 ft.

Limestone, massive, gray, very hard,

1 strong ridge make, highest ridge here 24 ft.

Sandstone, fine grained, pink, mostly thin bedded, partly massive, ~~and~~ near bottom making weak ridge, thin bedded part cross bedded, mostly weathering rapidly ——— 50 ft lies on E. slope of escarpment.

Sandstone, gray or yellowish, coarse, or medium, rather strong making low escarpment ——— 2 ft.

Sandstone, red, thin bedded, one zone dark and rather shaly, all fine grained, weathers readily ——— 33 ft.

Chugwater or Lycopine red shales, with strong gypsum zone

Jurassic buff + gray sands or shales

Dakota sandstones with intercalated shales

Beuton shales (found no limestone bands)

Niobrara in several ridges

All below the Chugwater effervesces freely in acids, unless the lower conglomerate

The base of the sedimentaries consists of coarse conglomerate, gray to dark red

and hard to friable. They are not sharply divided from the equivalent of the Lyons beds above, but pass into the latter by a zone of alternating coarse sands + conglomerates and fine grained sandstones, and gradually becoming more calcareous. The Lyons, ^{equivalent} differs from the beds near Boulder in containing limestones, and in being more easily eroded + softer in general, more or less calcareous. The Fountain differs from the beds at Boulder in being much weaker + not making a ridge. The Lyons grades into the Lykins by an alternation, the pink sandstone being overlaid by ^{a few feet of} deep red clay, then another few feet of the pink sandstone, then the red beds begin in ~~earnest~~ earnest.

The North Poudre ditch turned into the Box Elder has started a period of ^{deep} erosion which is extending up the lateral gullees by headward progression.

Owl Canyon, Saturday,

June 15, 1907.

Left for Ft. Collins at 7:30 a. m., Robbins & I in the saddle. Visited the Belleview fold on way down. Found it was Lyons formation, very narrow, the dip on the west limb very steep (estimated at 60°), the Poudre cutting through it, while Belleview occupies the syncline to the west. Reached Collins at 11:15 & had boxes ^{ltd.} ready for shipment at 11:45. Dined at hotel and took 2:05 p. m. train, reaching Boulder at 4 p. m. It has been a very hot day, with a hot wind.

Magnolia-Rabbitsville

Aug. 22, 1907.

Dr. Rowley & I started by team at 7 a.m. On divide S.W. of Magnolia we stopped & collected mollusca and plants, with a few scale insects, etc. Then drove to the lake beyond the school house. In the lake we collected leeches, crustacea, water beetles, frogs etc., and the following mollusca:

Lymnaea palustris

Galzeulina sp.

Planorbis exacuus

In the quaking aspen groves ^{and willows} along the divide we collected the following mollusca: altitude 7500 to 8500 ft.

Pyramidula croubiteri authorji common

Valonia cyclophorella scarce ^{only found} at ^{the} ^{school} ^{house}

Succinea cf. *avara*? a few

Vitrima alaskana common

Louitoides arboreus common

Encourulus trochiformis common
Bacchicapa lubrica? 1 specimen
Pupilla or *Pupa* *Rifidaria* sp.

Reached home at 6:45:

South Boulder canyon

via Flagstaff road

Aug. 24, 1907.

Dr Ramaley & I started for South Boulder by train at 7 a. m. Stopped at Hessler ranch & he collected plants while I collected mollusca. On aspens

found *Valbonia cyclophorella* common

Vitrea alascana a few

Succinea cf. *avara* a few

Lomitoidea arborens common

Pupilla sp. a few

Encourulus trochiformis

In the edge of pine forest under pine boughs on pine leaves (*Pinus scopulorum*) found *L. arborens* & *Valbonia cyclophorella* sparsely. On South Boulder below

the Langridge will found also
Agriolimax campestris. Not good
collecting ground for mollusca.

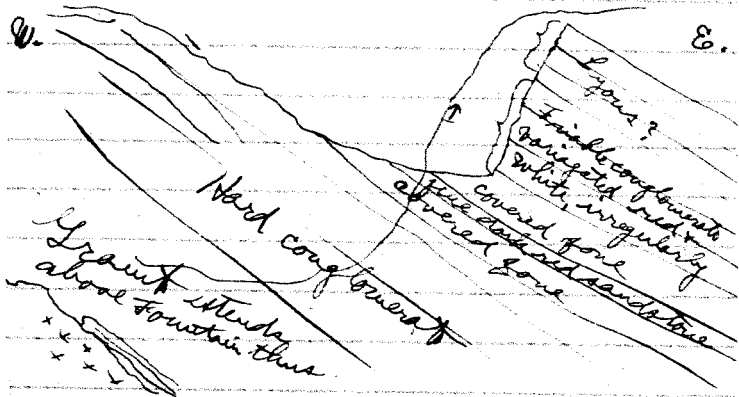
Pyramidula notably absent, though
common S. W. of Maguohi. Saw
~~500~~ 50 nighthawks flying S. by S.W.
in a scattered flock S. of Kessler
ranch, and 20 pinon jays by
roadside near head of Gregory
canyon.

Saturday Sep. 6, 1907

Left Hand Canyon

Started with Nellie Rust, Lillian McCracken and Mrs Henderson at 8:10 for mouth Left Hand Canyon with team & surrey from Fields & Lucas's Stable. Took Red Hill road and reached Left Hand at 10:15; Fountains conglomerates & sandstone there several hundred feet thick & well exposed north of creek just above where we reached Left Hand. Chiefly hard, coarse red sandstone with bands of coarser conglomerates in places very rich ^{dark} red with white patches as if from leaching out of iron oxides. S. of creek dip N. ^{63°} ~~40°~~ E. = 38° near contact + 38° near top of Fountains. N. of creek Fountains exposure is 150 paces horizontal extent E. + W. with dip 30 to 40 degrees easterly. Formation strongly calcareous, with some traces of

line on some exposed surfaces.
 Down creek a short distance below
 where the stream turns northward
 about 200 ft. (106 ft. measured, balance
 estimated) occurs east of stream be-
 neath the Lyons or part of it.
 It appears not as hard as that
 west of creek and is comparatively
 free from feldspar crystals. In the
 creek bed between these two exposures
 is a bed of thin bedded rather fine
 grained intensely red (dark) ^{or buff?} sandstone.
 The relations are about thus



The upper friable conglomerate is exactly like that on N. Boy Elder just above junction with S. fork, but is not at all effervescent. at Boy Elder, however, there is no hard conglomerate beneath it. It rests on the granite. I am inclined to believe the hard stuff is older & begins to come in at Owl Canyon where I found it in contact with the granite. After dinner I found outcrops of the conglomerate in the creek bed and west of the creek in such positions as to practically connect the different conglomerates through the covered zones. The clean exposure ^{of conglomerate} E. of creek measured this morning has a pinkish appearance due to the intermingling of white & red, making a well defined difference in color from the evenly reddish overlying Lyons sand stone. The conglomerate passes gradually into the Lyons by

variable beds, varying in coarseness, from minutely to coarsely crossbedded, very irregular in stratification, with undoubted evidence of eddying shore currents. The main body of Lyons forms the nearly vertical face of the escarpment above the Fountain slope, and is rather uniformly ^{dip} bedded and fine grained. The east slope of the escarpment about follows the dip. Lyons has strong regular crossbedding instead of irregular ^{as} in the Fountain thus



The directions of dip are often exactly reversed.

Geological Survey Account

Oct 2, 1907	fare	1.00
" 4	Hotel & stable Liversmore	2.50
" -	Team Mt. Ave.	5.00
" 5	Saddle horse Mt. Ave.	8.50
" 6	Hotel bill Northern	
" 8	fare to Ft. Collins	12.00
" 8	Team at Belle.	1.35
" 9	" & driver Mt. Ave	2.50
" 9	dinner & feed for team (Hanks)	4.50
" 10	Saddle horse back of Belle	.50
" 12	Team & driver 2 days Loveland Branson & Charlton	2.50
" 13	Bushnell hotel (Ivan Barr)	8.00
" 13	Fare - Loveland to Boulder	4.00
" 11	Hotel Northern	.95
" 15	fare round trip Boulder ^{Bethoud}	9.00
" 18	Round Trip Bethoud Loveland	62.30
" 18	bit stars Barn, Livery	1.75
19	Branson & Charlton "	.40
19	Bushnell Hotel	9.00
		3.50
		.85

Ft. Collins, Colo.

Wednesday Oct. 2, 1907

Left Boulder at 5:20^{P.M.} on time, arrived Ft. Collins 7:30, 10 minutes late, 45 miles. Day closed cloudy and threatening, but clouds showed westerly air currents. Went to Northern Hotel, and had supper. Nellie accompanied me.

Thursday Oct 3, 1907


A cloudy, gloomy morning & cool, with north wind. We started by train for Livermore at 7:30 A.M. Stopped to examine and map the fold north of La Porte in Dakota sandstone. In this region the escarpments ^{and dips} are such that folds can be detected at a great distance by changes in the strikes of ridges. The Jurassic is well up on the

slope of the Dakota escarpment except just inside the Cacheela Poudre canyon, where it occupies the valley or a portion of it. Heard meadow larks singing all along the road. Saw one good sized flock of bluebirds and many sparrow hawks. Along the "Lykins" Valley from the La Porte fold to Owl canyon there are two light colored ^{low} ridge making sandstones at the owl canyon end of the area and one at the southern end. Made coffee and ate lunch at Owl canyon at noon. at 12:45 it cleared off rapidly. Hitched up and drove out to the mouth of the canyon at 1 p. m. In the sandy shelves between the two sandstone ridges of the Dakota we found a 4-inch stratum literally filled with fossil *Ostracoidae*, but in very poor condition. Collected a lot, hoping that some of them may prove determinable. Reached Livermore at 5 p. m., stopped at

Ramer House, C. W. Ramer proprietor.
alt. ~~5-733~~ 5-733, P.M. on sidewalk in front of
Hotel.

Livermore, Colo.,

Oct. 4, 1907.

White frost this morning. I arose
at 6 a.m. and looked around a little before
breakfast. Drove west, about a mile west
of Livermore just N. of road is ^{apparent} a fault through
contact of Fountain and Lyons, S.E. side
of fault dipping N.W. $0-5^{\circ}$ and N.W. side
dipping N.E. thus 

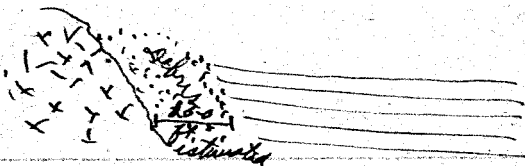
Upon more careful examination I found it
was plainly a ^{very sharp} fold, thus

Taking N.E. in
sharp eroded
trough



Other changes in dip immediately west,
then dip becomes normal and continues
so to the granite. N.E. of where Rabbit
Creek emerges from the granite the
Fountain appears to butt squarely
into the abrupt slope of granite

thus:




Lunched at Owl Canyon at noon
& started on at 1 p. m. 1st gulch S. of
Engleside I left the team with Nellie
& started back of the Lyons ridge
on foot. In Fountain-granite contact
just S. of gulch is a white quartz
outcrop, strike N. of W., large chunks
of the quartz rolling down over the
fountain. It makes a ridge. Foun-
tain & Lyons same here as at
Owl canyon. Fountain barely
extending up on granite slope. From
there south to where the strike changes ab-
ruptly to the west the Fountain, if it exists
west of the thread of the valley, is covered
with soil on the gentle slope. It appears
at the base of the Lyons escarpment
all along, but, as northward, is weak
and usually but little seen in the
valley or on the granite slope. Reached

Ft Collins at 5:20. after supper
called for Kittle - J. L. Bartlett and Mrs.
Collins by phone at Greeley & Boulder,
but did not get Mrs. Collins. Saw 29
crows in one flock near Ingle's side flying
S. E. Bright, warm day

Ft. Collins, Colo. Oct. 5-

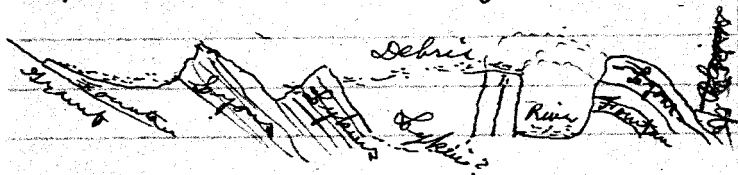
I started for La Porte and Bellevue
at 9:45 - on horseback, leaving at the
Hotel Nellie, who expects to go to Greeley
on the morning train, where she
will join the Kittle auto party for
Boulder. Where the road to Bellevue
crosses the "Dakota" sandstone it
is divided into two distinct and
massive members, with a covered
interval of 100 yds. or more, ~~is~~
~~terminating~~. Back (west or N. W) of that,
in the ^{vicinity} Lykins, we find the same light
colored, crossbedded ridge making sand-
stone so persistent further north.
at Head of Bellevue fold on N. slope

the dip is ^{30° and} W. by N., that limb not having been entirely eroded away by the Boche a la Poudre, but the stream is now undermining it into a bluff at one place, thus, looking South 

In the bay N. W. of Bellewin fold, where the road running W. on N. side of river passes the end of the Lyons ridge, where the big canal cuts through ridge & a lot of rock is thrown out, the formation is very red and massive, ^{dip N. 25° S.} along the stream which flows east of the ridge, but S. of the road, the light colored crossbedded Lykins sandstone follows the W. side of stream, dip 20°. S. of the river this sandstone makes a high ridge, ~~and~~ and they have quarried the massive red Lyons sandstone. I lunched, fed the pony and rested from 12 M. to 1 P. M. where I nested tree sparrows and chickadees were abundant, saw a Killdeer. Meadowlarks were singing here as the

house finches are in town.
very few outcrops in the bay N.W. of
Bellevue fold, but enough to show the
relations of formations. The normal
~~Lyon~~^{Fountain} ~~structure~~^{Lyon} next to granite is
much more like typical Lyon further
south, but still with some limestone
bands (thin) and calcareous sandstones,
as shown by effervescence. Lyon
Fountain still mostly covered.
at Bellevue light colored Lyons sandstone
is good building stone and flagging, par-
ticularly the latter. The Bellevue anti-
cline is an elongated dome N.W. & S.E.
The river has cut through the Lyon
and very deep into the Fountain, which
is well exposed in the escarpment on
E. side of river but covered in the
valley. West of Lyon, ^{normal monocline} escarpment
N.W., W. & S.W. of Bellevue the
Lyon outcrop in very few places,
but is occasionally exposed on the
western slope of the valley, and on

the south bank of the Cache la Poudre nearby the whole series is exposed. ^{E. 1/4} Cross section W. of Belleview:



S.W. of Belleview, again, I found the uniform decidedly red (not as deep red as the Lynkin except the crossbedded sandstone) Lyons, but not even a narrow white limestone band as a mile or so further N. N. to the Wyoming line and also in the Belleview anticline the Lyons is variegated, banded broadly by alternating pinkish or reddish and grayish or whitish zones. Nothing of this kind appears S.W. of Belleview and but a narrow band of gray a mile north of that locality. The Lynkin remains very deep red, thinbedded, with the white ridge making member, always strongly crossbedded, in about the middle of the series. Hot and dry, & bright day

Ft. Collins, Oct 6, 1907.

Left Ft. Collins on the 8 a. m. train, arrived in Boulder about on time. Hot and bright.

Ft. Collins, Colo.

Tuesday, Oct. ~~14~~⁸ 1907.

Left Boulder on 9:28 train, about 15 minutes late. Bright, beautiful morning, dined at Northern Hotel, then drove north past Terry Lake to Rocky Ridge Reservoir No. 1, about 6 miles. Found Fossil Creek sandstone just E. of Terry Lake. The road practically follows the ridge made by the sandstone. It is just as at Fossil Ridge, S. of Ft. Collins, sloping gently ~~to~~ on the east side of the ridge and more steeply on the west side. at Rocky Ridge Reservoir No. 1 it

forms steep, much dissected bluffs, which give to the reservoir its name. The dip changes rapidly at the latter place, along the ridge from Terry Lake northward the dip is easterly and only about 5° . Then it changes to N. & then N. by N. W., ^{remains about} (about 4° or 5°) and swings around to the north end of Rocky Ridge Res. No. 1, the strike changing in response to change of dip. There is a series of reservoirs west of the ridge about which large ^{flocks} of ducks and numerous large gulls were flying. The sandstone, as at Fossil ~~Creek~~ ^{Ridge}, contains large numbers of Duoceramus oblongus and some of the other Duocerami found at Fossil Ridge, but I only saw two or three Pinna Lepesii and Bauleites compressus, one Ballita, one Scaphites nodosus, a very few Ostrea of O. inornata, Anomia rectiformis is common

and there are some Nalyruenites
major. I saw no Placenticeras
or other fossils except those mentioned.
The formation is practically the same
as at Fossil Creek, gray sandstone
containing numerous ironstone con-
cretions, some several feet in diameter,
the formation having a tendency toward
forming an escarpment on the west
side of the ridge and a gentle slope on
the east side.

Ft. Collins, Oct. 9, 1907.

Started for mouth of Owl Canyon
at ~~8:55~~ 7:55 A.M. (25 minutes late on account
of slowness of livery man) with team and
driver ^{from Mt. Ave. stable.} Took the road running north
from La Porte, following the Niobrara
ridge most of the way. Found
Benton formation mostly covered
in a valley west of Niobrara, but
outcropping in places as a calcareous
sandstone ~~at~~ just below Niobrara
limestone, indeed forming a trans-

tion gone to the limestone. Limestone
Niobrara about as elsewhere, the
three ridges usually showing, the
eastern one often making an abrupt
slope to the Pierre Valley. No Pierre
exposed so far as I saw, occupying
a rather flat, undissected valley. To
the east could see Fossil Creek sand-
stone extending northward from where
I traced it yesterday. Niobrara contains
D. depressa and O. congesta in about the
usual condition as from Boulder
northward. Arrived where Owl Canyon
beaks through Dakota Ridge at 10:45.
I got out and the driver went on to
The Forks to get his dinner and feed
the horses. In the upper Niobrara I
noticed some tendency toward minor
folds where the big ditch cuts through it
4 or 5 miles S. of Owl Canyon, but I
did not examine the region particularly,
merely noting a few dips. at Owl
Canyon (mouth of) found great numbers
of Ostracods & Inoceramus. The

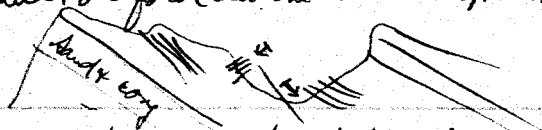
latter look very much like D. labiatus.
 They occur in ~~hard~~^{calcareous} bands about half
 way down the west slope of the upper
 sandstone member of the Dakota ridge.
 Beginning at top of ridge we find, not
 the usual hard, thick bedded sandstone,
 but a softer, thin bedded sandstone,
 weathering rapidly, to perhaps 20 feet
 thick, ^{with numerous Spirifer?} Below this are possibly 50 feet
 of sandy shales, including the fossiliferous ~~lime~~^{calcareous} bands, the pure sands not at
 all calcareous. Below this 50 ft. of ^{or more} non-
~~calcareous~~^{supercalcareous} thin bedded black and gray
 shales, much like those of the Benton and
 Pierre, now fossiliferous extending to
 bottom of lateral gulch. Below this, on
 east slope of west ridge, friable sandstone
 This is underlaid by typical hard "Dakota"
 sandstone and conglomerate which form the
 crest of the second ridge, thus

Lepkina

Hard sandstone
 + conglomerate
 Jura-Morrison

sandstone
 sandy shale
 black shale
 soft sandstone


Nearly a mile north of the road there is either a fault or fold in the Dakota, N. & S. thus



Exposures are too poor to determine the exact condition.

Ft Collins Oct 10, 1907

Left hotel at 7:30 a.m. on a horse from the stable back of Belli which makes a specialty of saddle horses. Rode west on the road which crosses the Railroad at the Passenger depot. at mouth of gulch found Niobrara and Benton in usual position, all covered except basal Niobrara limestone which makes ^{up} low ridge. The ^{lower} Benton ^{shales} however has been rather extensively quarried for brickmaking south of the road, making a fair exposure, in the upper part of which I found a thin bed of Ostrea, apparently the same undescribed species found at Six Mile, N. of Boulder, and in the

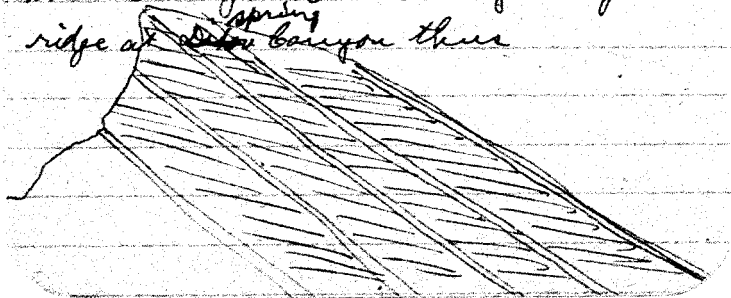
same condition, with other thin
 limestone strata above it. Here the
 strata forms 3 distinct benches, the
 Lykins has a dip of 27° , the medial
 ridge making member rises nearly as
 high as the Lyons, with the valley
 consisting of a lateral runing each way
 from the pass but not very deep at the
 pass thus: E  The Lykins and Lyons
 here are both quarried, the former to a
 limited extent, the latter extensively. The
 Lyons furnishes large, fine blocks of
 flawless sandstone of a uniform
 red color, not very intense red, it
 is much thicker here than a short
 distance northward, massive and
 uniform, sharply differentiated from
 the Fountain in the escarpment
 both in texture and color ^{but conforable!} The basal
 and third beds 15- or 20 ft thick are
 strongly crossbedded in the escarp-
 ment where it faces S.W., thus:



Lyons

Fountain Purplish red conglomerate ^{reversed and}

a large part of the Fountain here is quite calcareous, in places might be called limestones almost. It passes abruptly into non-calcareous ^{fine} red sandstone above, but conformably. Could find no fossils. There are probably over 200 feet of Fountain + same amount of Lyons up to Ten Sleep sandstone. There is a little lime in Lyons in places above base but no well defined horizons and no limestone. In Lyons above the cross bedded sandstone is a limestone bed similar to that at Boulder which has been burned for lime. The Dakota has been quarried a little at one place. The Fountain is friable and occupies a north + south valley as northward with tendency to harden at very base as at Owl Canyon. Cross bedding in Lyons ridge at ~~Dakota~~ ^{spring} canyon thus



The Morrison from ^{where I struck foothills} ~~the~~ south for at least several miles is covered with talus except in one or two places, which show its existence plainly. At Stout, in Spring Canyon there is a 6 foot stratum of hard crystalline limestone near top of Lyons, just below the Ten Sleep sandstone. The formation is much thinner than where I struck the foothills ~~at~~ $4\frac{1}{2}$ miles north, not nearly so massive, and separated from Fountain by the same sharp line, though 40 ft down in the conglomerate is a 10 foot band not distinguishable from the Lyons above. On the whole the appearance of the escarpment is much more like that at Owl Canyon than it was ~~at~~ ^{at} Bellevue, ^{not the fact} or $4\frac{1}{2}$ miles north of here. Southward found good exposure of Morrison on slope of Dakota ridge, consisting, as usual of soft, variously tinted sandstones and shales underlain by Lyons thin bedded ^{red} sandy shales, including massive layer in

which Fennerman thought he had found fossils at Boulder (containing concretions of same sort) and the Morrison overlaid by "Sakata" conglomerate. A little further south about 25 or 30 feet of hard limestone is exposed at top of Morrison & formation seems much thicker. This limestone probably exists at first outcrop, but if so is covered by talus. Finished the Ft. Collins quadrangle and not having the Loveland sheet with me and the horse being tired, I came home reaching the hotel at 4 p. m., very tired. Worked hard all day. Following is a list from memory of birds I have seen here last week and this week.

Meadowlarks - abundant and singing in valley and as far west in the mountains as I have been, 4 miles west of Livermore

Robins - common in valley, ^{in flocks} Have not noticed them closely, but this morning noted one *M. migratorius* with flock of *M. m. propinqua*.

Mt. Bluebird - saw a large flock at
Ingle side, and another (yesterday) in the valley.

Sparrowhawk - abundant

Marsh hawk - Have seen a number,
always singly.

Red Winged Blackbird - Quite common, have
seen no large flocks yet.

Brewer blackbird - a few

Veery sparrow - a few

Shore larks - common, especially in the
mountains (foothills).

Gulls - Probably ring billed - numbers on
Rocky Ridge Reservoirs.

Ducks - same as gulls.

Great Blue Heron - one.

House finches - singing in towns.

English sparrow - In towns.

Hill deer - common

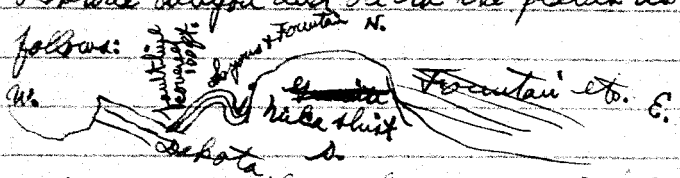
Mourning dove - Not uncommon

yesterday and today there was frost
in the morning. yesterday it was cool
riding all day. Today it was quite
hot. Both days were bright.

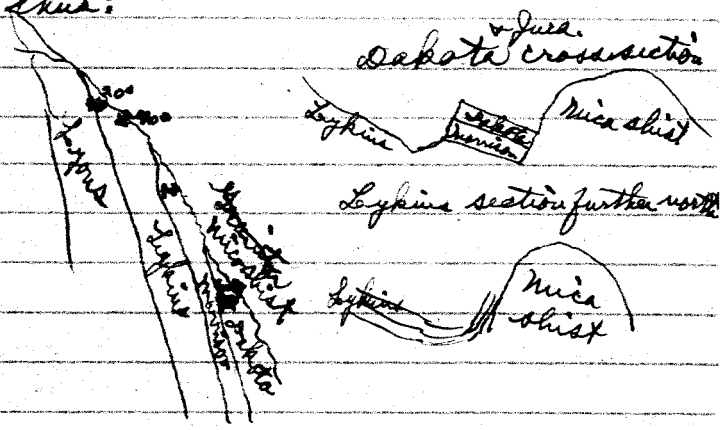
Louclaud, Colo. Oct 13, 1908

Left Ft. Collins at 8 p. m., reached
Louclaud at 8:30, put up at Bushnell
Hotel. Got team at stable
& drove up Big Thompson thence up
Burdhorn & ran to plat the Arkins
fold. West limb of anticline, "Dakota"
sandstone and Niobrara dips S.W.
70° to 75°. W. limb of syncline much
more ~~so~~ gentle as also E. limb
of anticline. The Dakota forms a high
narrow ~~dyke~~ ^{escarpment} of the hard sandstone.
The Fountain is in escarpment. The valley
west of granite intrusion is covered, mostly.
The dipper of zone is hard, light colored,
exactly as in the quarries N. W. of Colorado
Sanitorium at Boulder. I have not made
copious notes on the Arkins anticline and
syncline, because they are normal on
echelon folds and the map gives about
all the data. At the northern end of

the syncline, however, east, northeast and northwest of Masonville, a peculiar condition exists. East of Masonville is ~~at~~ a fold (anticline) ^{in the younger formation} which is cut off entirely from the strata east and west. A cross section from Masonville east through Redstone Canyon and on to the plains is as follows:



At Masonville the Dakota, and Lyonias and Lyons butt squarely into ~~granite~~ mica shist ^{and play out}. The Dakota does not appear to be dragged up, nor does the Jura, but the Lyonias is dragged up sharply, thus:



The two shist mountains shown on the map tower far above the sedimentaries flanking them. The dip of cleavage planes is very steep, dipping west, with a strike a little W. of N., approximately the same as the sedimentaries to the west, and so pronounced as to make the mountains in places look as if composed of stratified rocks. The western formations are a normal monocline. The anticline east of Masoville seems to have overturned and developed into a thrust fault which has carried it up over the Dakota, and all formations above the Lyons have been planed off. It seems likely that these formations formerly extended over the high mountain and joined the corresponding strata to the east in the present monocline, or rather that the strata were continuous in a ^{more} nearly level position before the development of the fold. Reached Hotel 6:15 very tired, having done a large amount of rapid climbing on foot and driven over 32 miles. Had a fine tear, though skittish and headstrong.

Following birds were overlooked in the Ft. Collins list made yesterday.
Crows - saw some several times in the valley and 29 in one flock in the foothills

Long crested jay - abundant in the foothills

Magpie - common in valley & foothills.

Towhees - Spurred or Arctic, do not know which, abundant along foothills in brushy places.

A large hawk - probably Swainson's or red-tailed (western)

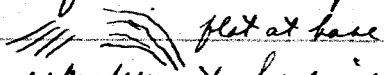
Flicker - common

Loveland, Colo., Oct. 12/02

Started with team and driver at 8:15 a.m., west on road that leads from south part of town west to foothills. At S. end of anticline the Lower Kiobrere forms a beautiful semi circular ridge like a broad railroad grade. Basal limestone on E. limb of fold dips E. by S. E. 25°, on W. limb W. by S. 40 degrees. Upper shales

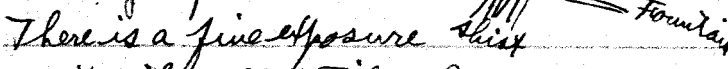
of W. limb 800+ overturning for upper
foot by creep. Benton shales here
steeper than basal Niobrara.

Near Loveland settling plant (S. of it) is an
anticline in the Lyons and Fountain. In
the center I found an outcrop there:



The western escarpment here is crowned
by Lyons, the Lyons forming a bench
on the west slope of escarpment,
the Fountain beneath it and sharply
differentiated as at Spring gulch.

The Fountain also extends up the
slope of the mountain. The latter
consists of nice shist, as ^{described} at
Massville yesterday, the Fountain
resting upon it there:



There is a fine exposure west
west of Loveland Filter Bed and Dam.
Lyons is quite thin, Fountain thick and much
as at Left Hand, 150 ft. (estimated) west of
drainage line up toward 15° on ^(shist) granite, and
about same amount below Lyons in
escarpment. The lower half - that west

of the medial line of the valley - is not
at all calcareous, but some horizons
in the upper half are slightly, others
highly, calcareous, almost limestone.
Reached ^{hotel} home at 6:30 after a hard days
work. Mapped a number of folds, in-
cluding those around Loveland fitter bed
and two S. of ~~line~~ Dry creek.

Berthoud, Colo., Oct 25, 1907

Left Boulder at 5:50 p. m., 35 min-
utes late, reached Berthoud at 6:50, 25-
minutes late. Rode to Longmont in
seat with F. M. Downer. Got supper
at Hotel + arranged at livery stable
for team for tomorrow, being unable
to get saddle horse. Stopped at Grand
View Hotel, W. M. Brady, Proprietor

Berthoud Oct 16, 1907

Started with team at 7:30 a.m.
West of Stever Reservoir found Teepee
Butte with Baculites compressus, Ostrea
cornuta and Lucina^{occidentalis} in quantities
but in poor condition. There were many
fossil fragments. Did not stop to
collect any. Found also Dicranurus
barbini, fragments of a large Heterosera
or Hebioceras and probably of a medium
sized Ptychoceras. 150 yds W. of the
butte the Nygine sandstone is found
dipping East about 15°; not at all cal-
careous. To the west the basal Pierre
shales + Niobrara dip E. 42°, the Benton
shales are somewhat crushed and the
boulder mass cap over the Benton is
well consolidated. Just within the
canyon the Dakota is badly tangled.
a section of the medial shales is thin.



A big fold in addition to several small ones spreads the "Sakata" over much territory here. The strong capping limestone of the Morrison can be followed clear around the north end of the syncline via Carter Lake. The west limb of the anticline, as usual, is steeper than east limb, from 50 to 80 degrees. The pink brecciated sandstone with limestone bands can be traced around the main syncline in the Lophins at head of Carter Lake. It is much as at Boulder. The medial gray sandstone of the Lophins is very hard & resembles the Lyons' sandstone of the quarries N.W. of Colorado Sanitarium at Boulder. (Quarry, is the latter Lyons?) In the underlying red sandstones of the Lophins at one place just west of the head of Carter Lake I found

numerous casts of fossil twines,
but unrecognizable in a coarse
sandstone. ^(These are casts of concretions) The Fountain extends
well across the West valley at
Chimney Hollow. Carter Lake has no
outlet now. It may be due either to
deformation or an outwash dam
of debris, probably the latter former.
Old terraces indicate that the
water once rose some feet
higher and that at one ^{time} there was
an outlet at the S. end. The S.
barrier is not now very high.
In afternoon I collected fossils in
the Benton. Found Truoceramus
cf. S. labiatus just below middle of
formation, with undetermined cephal-
opods and the undescribed oyster found
near Boulder and west of Colby. In
two or three thin limestones in the
upper half of the formation I found
the usual abundance of S. labiatus
and a few cephalopods. Reached

hotel at 5:30. It has been very warm in the sun today.

Berthoud, Oct 17, 1907

Started with sorrel team at 7:30 Grove W. & then S. Just before reaching Little Thompson on road next to foothills found a sandstone E. of typical Hygiene. It was soft and fine grained below with a two foot hard and coarse stratum of darker color than the other. On E. side Rabbit we have unusual case of an anticline with E. limb much steeper than west limb. Killed a rattlesnake on Dakota Ridge W. of Lykins ranch. Struck an outcrop S. W. of town & E. of the Hygiene (1 1/2 or 2 mi.) which looks much like concretions of Fossil Creek sandstone, but

decidedly lime concretions. Contains
a few Triceramus sagensis and
probably T. barabini. Collected Valonia
cyclophorella, Orcebia strigosa,
~~Or~~ Trochitoides arborea and Pupilla
sp. where Little Thompson breaks
through the "Sakota" ridge. Went
south nearly to St. Vrain. Reached
hotel at 5:30. Cloudy, with raw wind
early forenoon, warm & bright afternoon.

Berthoud, Oct 18, 1907.

Started at 8:30, driving west and
north. Hazy over the mountains and
a cold northerly breeze blowing, changing
later to easterly. North of Lone Tree
Lake I found a strong outcrop of typical
Hygiene sandstone dipping S.E., 15° , contin-
ing ^{N.W.} to S. W. corner of Loveland. Its strike,
continued S. E. would about meet the
outcrop W. of Berthoud. No fossils.

Returned to hotel for dinner at noon, and packed the fossils from W. & S. W. for shipment. In the afternoon started north at 2 p.m., then east to E. line of Loveland Quadrangle, around Twin Mounds, thence S. of Big & Little Thompson, where I found Fox Hills strata containing *Cardium speciosum* etc., E. of road & S. of creek. Reached hotel at 5 p.m. Took 6:25-train for Ft. Collins, ^{Loveland} arriving practically on time and after engaging the little black team I used last week I went to the Bushnell Hotel. Nearly in collision with runaway car as we pulled into Loveland.

Loveland, Oct. 19, 1909.

Started by team at 7 a.m. drove up above Massowille and traced out the sedimentaries to where they ended. In the shist E. of the fault plane

There has been some mining prospecting. Then crossed into Redstone canyon and traced the Fountain, Lyons and Lykins up about $3\frac{1}{2}$ miles to where they ended. Fed the horses here at just noon. Reached Hotel at 3:15 p.m. having driven about 45 miles with a fine team. Reached Boulder at 5:55 p.m.

Boulder, Oct. 22, 1907.

Left Boulder at 9:45^{a.m.}, 25 minutes late, reached Loveland at 11 a.m., with G.S. Dodds. He went on to Ft. Collins by train while I got off and started north on foot with the idea of meeting Dodds at Fossil Creek with horse and buggy. At intake s. end of Loveland lake I found the Hygiene sandstone with usual characters including some greenish yellow strata, dipping east, 80° ; one stratum containing numerous

Inoceramus barabini, I. obliquus
and Anomia ractiformis, all poorly
preserved. I have now no doubt
of its identity with the Fossil Ridge
sandstone. Passing thence around the
east side of the lake the Inoceramus obliquus
increased rapidly in numbers and I
found several Scaphites nodosus. Found
no outcrop at extreme north end of
lake. Thick sheet of clay exposed.
In bottom of ^{outlet} ditch there appears to be a
soft sandstone, probably the same
one as at south end. Along east side
sandstone is unmistakably the
Fossil Ridge formation. The fossils
at Fossil Ridge are mostly in upper
part (eastern part of exposure) as here.
Passed northward then along RR track.
Saw occasional evidence of the sand-
stone on both sides of track and
believe the ridge east of track
all the way is composed of it
as at Fossil Ridge. Reached Trilby
schoolhouse road at 4:45 and found

Road with horse & buggy. We reached hotel Northern at Ft. Collins at 6 p.m. There seems now no possible doubt about the Fossil Ridge sandstone being continuous with the Hygiene.

Ft. Collins, Colo., Oct 23, 1908

Started S. at 8 a.m., collected fossils where Fossil Ridge Creek breaks through the ridge and crosses the road, then drove S. to Tribby schoolhouse and turned east visiting the sandstone outcrop $\approx 1\frac{1}{2}$ miles east. It dips E. 8° , and is indistinguishable from the Fossil Ridge sandstone, but contains no fossils except a few Inoceramus cf. barbieri ^(see below). Probably represents upper member of Hygiene sandstone as found further south, but much further from the lower members. Upon further search found quite a number of fossils, all of which were I. oblongus, but

small specimens, and Dodge found Halysites major. The concretions are just as at Fossil Ridge. It is possible that it is a fold. N. of Trilby schoolhouse we found a good exposure just S. of Brick yard and E. of R.R. track. At base there ~~was~~ ^{is} a transition zone from shale to sandstone, above this are about 40 feet of rather soft, irregularly bedded sandstone, then a covered zone of a few feet, above which is the hard, massive, concretionary, fossiliferous sandstone about 50 feet, the whole dipping easterly 9°. Reached hotel at 6 p.m. I have been ill all afternoon, having severe intestinal pains. Got a shave and haircut in evening and at 8 p.m. Chas. A. Lary called on me.

-44-

Fit. Collins, Oct 24, 1907

Started N. with team at 8 a.m. On W. side of reservoir system, at Rocky Ridge Reservoir No. 1, found a greenish, coarse,

friable, impure sandstone, irregularly
bedding, dipping E. 12° & in passing N. changing
to N.E. 20° , thus passing under the typical
Fossil Ridge sandstone E. of the Reservoir.
Proceeding E. along ditch bank half way
to the Fossil Ridge sandstone, found im-
pure sandy shale all the way dipping
N.E. 18° to 20° . Going W. & N. around head
of Douglas Reservoir No. 10, we found
an outcrop of sandstone making a
ridge a mile E. of the Fossil Ridge
sandstone, along W. shore of Demmel
Res. No. 2. The Fossil Ridge sandstone
along E. side of Douglas Res. No. 10 is
a typical massive sandstone with
a tendency toward greenish gray color,
containing hard and darker concretions
just as at Fossil Ridge. Fossils
much less numerous than further
south & consist only of Helmenites
major, Proceramus barbinii,
Callista ~~subsp. nov.~~ ^{Alvint}, Anomia ractiformis
and bandium speciosum. Collected

a few fossils at Rocky Ridge Reservoir No. 1 - and reached livery barn at 4:10. It was cloudy at daylight, but not cold. Temperature fell during the day, at noon it began to sprinkle and at 4 p. m. developed into light rain. Prepared a box of fossils for shipment before supper, still drizzling at bedtime.

Fort Collins, Oct. 25, 1907.

Still gloomy, damp and muddy, but not raining this morning. Spent forenoon at hotel waiting to see what the weather would do to us. Started to Windsor by train at 11:40, late as usual. Went to American Hotel and had dinner, then started for bluffs on S. side Cache la Poudre S. E. of Windsor - 3 mi S. + 1 1/2 mi E. Found the bluffs about same as

at our 1906 camp, 3 miles further east, massive ^{greenish} yellowish sandstones above, quite friable, with hard dark colored stratified concretions and concretionary gouges, and darker colored shales below. Found *Urota* and numerous gastropods above and *Verrillia humilis* and other fossils below as at the other camp. strata practically horizontal. There is an exposure of several hundred feet of strata in the bluffs and crowning slopes. It nearly cleared during afternoon and became much colder. Reached hotel at 5:30. Have had trouble with left eye all day - catarrhal conjunctivitis. The zinc solution I carry appears to have decomposed, so I cannot use it. I got some boric acid and hope that will do the work.

Windsor, Col. Oct. 26, 1907

A cold, frosty morning. My eye is somewhat better, but by no means well. I am quite warm soon after reaching the bluffs where we worked yesterday. The base of the bluff at water's edge and for some distance (perhaps 50 ft. or more) is of black shales much like the Pierre at Boulder. Saw no fossils in it. Above it passes gradually into yellowish sandy shales and sandstones (very friable). In the black shales 25 ft below the yellow we found Verrillia humilis but none above. In the ^{yellow} sandstone found Nucula sp. but not in the black shale except at the very top. Bardium speciosum, Mactra and Tellina common to both horizons. Have not seen what Bodds has. Started up stream at 11 a.m. ~~After~~ After lunching and

feeding the horses we drove to a gulch 2 miles S. W. of Windsor. The gulch has cut deeply into Pierre shales with some narrow sandstone bands. Found but 2 determinable fossils, one Asteris imbricate and another which I do not recognize but which I also found in the upper Pierre shales at the first station this morning. Then we drove S. & W. around the long gulch, reaching a point about 6 miles S. W. of Windsor, & crossed the Cache-la-Poudre 3 miles west and 1/4 mile N. of Windsor, crossing Fossil Creek just before crossing the river. On the bluffs just before reaching Fossil Creek we crossed what appears to be the yellowish concretionary Fox Hills sandstone as found S. E. of Windsor, but it was dipping sharply toward the E. or N. E., from which we must infer a fold. The Cache-la-Poudre S. E. of Windsor looks and smells

like a sewer, in spite of its great volume, but is clear sweet of the town. It is probably the waste drain from the sugar factory. Reached Windsor at 4 p. m., packed our material and shipped it. Dadds left on 5:30 train for Fort Collins and I took the 8⁰⁰ o'clock train for Greeley, where J. L. Bartlett met me at the depot. Nellie had gone up from Boulder on the morning train.

1907
~~Feb 6~~ Greeley, Oct. 27th

J. L. Bartlett + I drove around town for a while, then met Grace and Nellie at the sugar factory and were shown through the plant by the assistant superintendent. Dined at the Campfield Hotel and I took the 1 p. m. train for Boulder, leaving Nellie to come down

tomorrow. It has been a beautiful day.

Berthoud, Col., May 28, 1908

cloudy and cool. Left Boulder for Berthoud on 9:28 train for Colorado Geological survey, about on time, reached Berthoud at 10:30, went to hotel, then to livery stable and ordered team. Had dinner at 11:45. Started west at 12:30. In ^{about middle of} "medial Dakota" shales we found Proceramus g. labiatus and Avicula linguiformis as at Owl bayous, with other spp. and many plant stems. In west limb of W. syncline basal Dakota sandstone is very massive and hard, and Morrison consists mostly of hard limestones and calcareous sandstones below, upper part covered. Found no fossils. The Dakota consists of friable sandstone at top, underlain first

by sandy shales, then black shales, with very hard, massive sandstones and conglomerate below. Found no conglomerate in the easternmost ridge of the basal sandstone, which would represent the off-shore deposits.

Reached hotel at 6:05 p.m. Retired early, very tired. Bloddy all day, probably worse or less.

Berthoud, May 29, 1908.

Arose at 6 p.m. A bright morning. Yesterday we saw 2 mallard ducks at mouth of gulch. On a lake we saw a blue heron and some black terns?. Orioles are more common in the villages like Berthoud than at Boulder. Lark sparrows abundant in foothills, vesper sparrows not so abundant. Started for gulch west of town at 7:15. First visited the fine anticline. Fountain there

contains very little limestone, and none
in upper part. Well up west slope of
anticlinal valley found massive con-
glomerate, overlaid by 10 ft. of thin bedded
red sandstone, then a bed of conglomerate,
then sandstone to top. Probably the
highest conglomerate may be consid-
ered top of Fountain. No unconformi-
ty. On ~~east~~ west slope of W. limb very
hard Lyons occurs. Whole thing
much metamorphosed, including
limestone well down in Fountain.
The limestone associated with "Cribbled" sand-
stone in the Lyons is just as at Boulder,
non-fossiliferous. Has been burned for
lime around Easter Lake. Some distance
beneath it on the W. limb of the syncline
is a hard sandstone just like the Lyons,
underlaid by typical Lyons micaceous shaly
sandstone, some of it very hard and containing
flat iron ore concretions which dissolve
out, leaving casts which resemble casts
of rather flat Pelecypoda. In one place

this extends nearly to crest of Lyons escarpment. Fountain west of Lyons escarpment, practically same as in the anticline first visited. Collected a number of cephalopods, including two large ones, in the Benton on way back. Reached hotel at 5 p. m., very tired, back aching, clear and quite warm out of the wind.

Mt. Wabazoum does not constitute a compact formation on the sandstone slopes ending abruptly at grass line below as it does at Boy Edeu. It is more scattered.

Berthoud, Colo., May 30, 1908.

Drove west from Berthoud and 2 miles north, then into gulch, where we found the Dakota ridges widely separated and the Morrison limestones

occupying the crest of the ridge and the west face, while between it and lower Dakota conglomerate were drab and greenish clays, quite hard. Dakota conglomerate coarse. Middle Dakota clays covered. "Dakota" is 30 ft or more sandstone at top, then ^{about} 50 ft sandy shale below, then 50 ft black clay shale, then at least 60 ft hard sandstone and conglomerate with a tendency to form two ridges. Near base of upper sandy shale are calcareous bands containing same oyster and *Luceramus* as at Oral canyon, with fish vertebrae.

S. side of gulch 3 or 4 miles north of where we entered foothills a ditch tunnel exposes Dakota-Morrison contact where a massive, light colored, iron stained sandstone rests ^{conformably} upon sandy shales, variegated, yellow, greenish gray and maroon. Lower are greenish shales, underlain by limestone. Here as further south, the limestones form highest crest of first

logback series. Dip E. 25°. Same ditch
emerges from tunnel in a ^{black} shale ^{sandy} band
which is probably the cause of the
the tendency of basal Dakota to separate
into 2 benches. ~~There is some evi-~~
~~dence of a nonconformity at base of~~
~~shale, between it and massive basal~~
~~sandstone.~~ No conglomerate here.
Shale about 20 ft. thick - contains
lots of vegetable fragments carbonized.
On S. side big ditch it cuts through
entire Dakota, making a fine exposure.
Low in the shale, below middle, find
the same fossils as further south.
Dip E. is a fine fold in Kiobrara.
Reached Berthoud at 1:30 and shipped a
big box of fossils.
Measured ^{Dakota} Jurassic section at
last canyon visited, as follows, gen-
eralized:

	ft.
Upper Dakota sandstone 50	30
Dakota shales	150
Lower Dakota S.S.	25-
^{Jurassic} Variegated clays, some parts calcareous ^{estimated}	30
(Some green fine grained s.s. in talus probably from above stratum)	
Hard l.s. with many minute calcite seams ^(est.)	40
^{Rather} friable light gray s.s. (or is it indurated clay)	31
Compact drab l.s., partly soft	30
^{rather} Light gray friable s.s. (10 ft. bluff in center)	5-8
Lozkins? light gray hard s.s.	12
go abruptly passing into pink, then into red. The gray is by leaching as shown by the irregularity of pink line, which does not follow stratification	

Left Berthoud on the 3:56 p. m. train, reaching Boulder at 4:00 p. m. Met Prof. George at depot, starting east to be married.

Boulder, June 3, 1908.

Instead of attending commencement exercises and taking my B. A. degree I started north on foot, up the "Lykins" lateral valley N. W. of Colorado Sanitarium. There the Lykins extends up, well on flanks of Lyons, with Fountain at top of second hogback. Morrison sandstone, limestone and clay (latter partly calcareous), pretty well exposed. In middle of Dakota shales 2 miles N. found a stratum filled with plant fragments and a few poorly preserved fish scales and vertebra. Here medial sandy shales are 90 ft. thick between the well defined walls, dip E. 80°.

In Two Mile the wrinkled sandstone and accompanying limestone are within 135 feet of the Lyons. Lyons is about 100 ft thick. Top of Fountain contains alternating sandstones and conglomerates

same is true all the way down, the conglomerates predominating. Lenses of fine grained sandstone occur in coarse conglomerate, these

~~are~~
Fountain very thick here. Creek beds afford most nearly complete exposure of entire Fountain section I have seen. At or near base found ^{a few} chert nodules similar to those at Box Elder, but no fossils in them. Found none elsewhere in the formation.

At 4-mile wrinkled sandstone is over 250 feet above the Lyons with good exposure and no indication of light-colored ridge making sandstone found in lower Lyons from St. Vrain northward.

Reached home at 5:30 P.M., very tired. An almost cloudless day, which would have been very hot were it not for a brisk, cool breeze which made itself manifest except in well sheltered places.

Coneder, Colo. June 4, 1908.

Bright morning with quite a cool breeze. Started north via Red Hill road at 8:50 a.m., horseback. At 4-mile + northward Lyons has a tendency to separate into two or more ridges, but with no inter-vening Lykins. Just north of Left Hand a porphyry dyke occurs in the lower Lykins, 50 ft. or more below the wrinkled sandstone, its lower limit is near the Lykins-Lyons contact. I estimated its thickness at 200 feet. The wrinkled forms a low ridge from here to the St. Vrain. In Lykins gulch is an almost complete exposure of Lykins + Morrison. Here there are about 50 or 60 feet of deep red sandy shales below the wrinkled and 300 or 400 feet of same above. The Lyons is widely spread here. Reached home at 6 p.m.

Boulder, Colo. June 5, 1908.

Started south over Chautauqua mesa on foot. Lyons here flanks the Fountain, with tendency to form a low ridge. Collected Quaternary fossils in Bear Canyon. On S. side of Canyon found upper Morrison shales well exposed. "Dakota" basal sandstone here about 40 ft thick, medial shales 50 ft. and upper sandstone with intercalated clay bands 60 ft. No fossils. Shales look as at Owl Canyon, lower part covered. No conglomerate at base of "Dakota". Went S. nearly to S. Boulder creek, but found no exposure of anything later than Fountain except a little Lyons on flanks of Plateaux of S. Boulder creek and Dakota where gulches expose it. Mesa debris almost tops the Dakota ridge on divide between ~~the~~ E.-W. gulches. On return found 150 ft. of

Hygiene sandstone exposed on east side
of isolated hill in mouth of Bear Canyon,
dip practically vertical, strike N. 33° W.,
containing *Succinea* spp. and *Baculites*
compressus.

Boulder, Colo., June 20, 1908.

Saddles and I started on horseback
for Coal Creek at 8 a. m. A very
hot day. Where the road running
S. from Marshall strikes Coal Creek
the Laramie sandstone and some
shales are well exposed with dip
E. 38° and strike N. 6° W. Rocky Flat
between S. Boulder and Coal Creek
has much quartzite in the debris
sheet, increasing southward.
Coal Creek valley is almost covered
with it, forming "windrows" in

many places, though there is
but little on the ~~see~~ higher mesas.
Following up creek to first ranch
house, we then turned west and
in old R. R. grade cut at edge of
mesa we found Hygiene sandstone
with typical fossiliferous concretions,
as at Fossil Ridge, containing
Baculites compressus, Isocerasmus
varianus, Sagenis and oblongus,
Heteroceras sp., etc. Then passed
up the gulch cutting into the moun-
tains west of there. Found quartzite
underlying Fountain, dip of Fountain
E. 38° , dip of quartzite S.E. 39° . To the
west of this is Fountain again, dip
E. 70° and a few rods S.W. same
thing dip W. $-^\circ$, possibly fallen down.
Bodds reported quartzite again W.
of this. "Dakota" here with 25 ft
of conglomerate at base, then 100 feet
covered, then 50 ft. sandstone.
Morrison sandstone and shales

exposed, but saw no limestones.

Boulder, Colo., July 22, 1908

Left Boulder on Interurban car at 6 a.m. for the Perry Park region. Bright, warm morning, with a few flying clouds. Reached Oxford Hotel at 8 a.m., had breakfast, then met A. Dehan and J. M. Lowman. Took 9 a.m. D. & R. G. train for LaSalle. At mouth Platte Canyon Cretaceous formations dip E. about 80° estimated from distance. Devon beds horizontal capped by ~~limestone~~ which has been quarried near Sedalia and Castle Rock, on both sides track. Reached LaSalle at about 11:15; changed clothes in the quarters of a resident, got dinner at a boarding house. In Stone Gulch, W. of LaSalle, found conglomerate in contact with friable, strongly feldspathic granite forming a very even floor. There are two or more very sharp

folds. Then we travelled north to Bear
Creek Canyon, at Col. W. E. Hughes' Country
Place. There we found lower Carboniferous
fossils in chert concretions in a sandstone
at about the same horizon as at Box
Elder, just at top of a red sandstone
very ~~red~~ dark red at very top and over-
laid by a very coarse pure white sand-
stone or conglomerate. A few feet of
shales intervene, the weathering of which
has tumbled the white sandstone into
blocks tilted in all directions, so that
we could not tell whether they were con-
formable. Reached Daban ranch at
7:15.

Perry Park, July 23, 1908

Up at 5 a.m., shaved, had breakfast at
6 a.m. Reached started for Maitou Park at 8 a.m.
on horseback. Reached Fish Ranch at 2 p.m.
About 2^{or 3} miles E. of ranch found fossils about
350 or 400 ft. above granite in red calcareous
sandstone, overlaid by strong brecciated
limestone. Base of sedimentary is hard.

coarse red sandstone, with 14 inch
 band of greensand about 60 ft. above
 base. The sandstone is more or less
 calcareous. Reached Abernethy's ranch at
 7 p. m., very tired.

Marion Park, Colo.

July 24, 1908

Up at 5:15, started at 7:30 a. m.

In gulch about a mile north of Abernethy
 ranch house, at N. end of pasture, found
 small exposure of granite at bottom of gulch.
 Section as follows, from base up:

Granite exposure	4
Rather coarse ^{massive} gray and white sandstone (upper half reddish - greensand about 25 ft above base)	43
Transitions to thin bedded red s. s. calcareous	10
<u>fossiferous</u> " " " "	57
Rather more massive s. s. with fossils	120

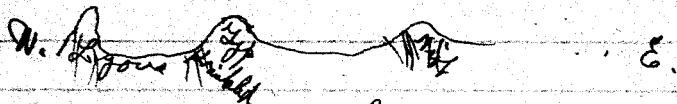
Massive l.s., not bedded, with spines & Productus — 10
 Pink s.s. with chert concretions — 52
 Same as next to last l.s. — 5

Grain surface remarkably even, showing cutting into sea cliff by waves at sea level. Long gulch is fault. Water has formed stalagmitic deposit locally called a volcano, 50 feet in depth. Granite weathered 10 ft down. Passed over a dirt trail down bow creek along slopes of 40° for above stream bed. Erosion is proceeding with great rapidity. Every little gully has a fine fan at its mouth. Reached Lemmy Smith's sawmill at 11:30, and had dinner. Rained during dinner. Have passed some good timber. At mill there were red spruce logs 2½ and 3 ft. in diameters.

~~at mouth of~~ Where ridge road reaches plain section is

L. zone exposed, vertical	ft.
" mostly covered, slightly overhauled	15-
"	66
Krinkled s.s. very calcareous, with limestone	24
Hypnum about	36
Covered valley	300

(The valley is undercoyeter of Benton
 about 20 ft from gypsum)
 Niobrara l. s. ridge about 40
 ft high



S. of road found Dakota in place. Reached
 Deban ranch at 4 p.m. very tired and
 spent balance of day resting. Rained again.

Perry Park, Colo., July 26, 1908

Up at 5 a.m., breakfast at 6 a.m.

Another bright, hot morning. Deban and
 I worked S. from ranch, west to foothills.
 Formations badly broken, faulted and folded.
 At Bear Creek canyon (Col. Higher Country Pl.)
 measured a section, as follows:

Granite	_____	ft.
Covered about	_____	15-
Massive light gray s. s. not very coarse		29
" red s. s.		5-
Thin bedded l. s. with chert fossils about		22
Pure white coarse s. s. with thin red band to top		of Deban

Just below latter we found thin band 1-2 ft very rich red, hard fine grained clay or sandstone, probably fossil.

The white sandstone appears to be the base of the Fountain, as ~~for~~ for several hundred feet above it extend coarse sandstones and conglomerates, overlaid by about 300 ft of Lyons sandstone, varying from white to red and forming a cliff. Gypsum bed strong in Lyons, Dakota forms 2 benches. Fountain dips N.E. 12 to W. degree, Lyons same S. of Lake, but W. & N. of lake it is vertical. We estimate Fountain at not to exceed 600 ft. Niobrara same as at Boulder, but has broken up and not appearing so massive. Collected *Lucina occidentalis*, *Baculites ovatus*, *B. compressus*, *Margarita nebrascensis* and *Scaphites nodosus* in a "tipel butte" S.E. of ranch and reached ranch at 2:30 p.m. Packed fossils for shipment. Downan had gotten for our suit cases, so I had a bath, changed clothes and feel quite comfortable.

Berry Park, Colo., July 26, 1908

Up at 6 a.m., breakfast at 8:45. Started at 9:55 in 2-seated carriage, with Frank Sebay for driver. Very bright, hot morning. Reached Uradaba at 11:40. Dined at hotel and got train at 1 p.m. Left Denver at 4 p.m. and reached Boulder on time.

Boulder, Colo., Aug. 10, 1908.

Cloudy, cool evening. Left for Ft. Collins on 8:50 p.m. train, taking Sievert Rohrer with me, late starting at 8 p.m. Fare, 2 round trips \$5.00

arrived in Ft. Collins 9:45, went to Tedman house. Has rained here

Ft. Collins, Colo., Aug 11, 1908

Up at 5:45, breakfast at 6:10, started with team from Tate & Walker's stable at 6:50, misty and cold. Stopped at

S. end of Bellevue fold and examined Lyons formation. It is about 150 ft thick, all hard s. s. - no l. s., mostly somewhat massive in thick benches. No barboiferous l. s. between it and the Fountain. Sharp line between purplish color of Fountain and very light reddish of Lyons as seen from a distance.

Just W. of river, N.W. of Bellevue, we examined the Lyons escarpment. The supposed thin l. s. seems to be a very fine grained s. s., slightly calcareous. Fountain covers Lykins crossbedded s. s. underlain by deep red friable Lykins thickbedded s. s. forms a very distinct ridge. Lyons has a tendency to form two benches here. At Engleside barboiferous limestone forms crest and east ~~sides~~ slope of ridge as at Owl Canyon with pink Lyons s. s. on its lower east slope. The lower Lyons is very uniform, but above are strata like Lykins alternating with other strata like Lyons. Fed horses and lunched here. Drove on to Grandma's Butte and searched for fossils.

in Lyons s.s. but found none. The carboniferous limestones contain many crinoid fragments, mostly small, but we found nothing. ^{are} continued misting and raining, so at 4 p. m. we drove to Cameron's hotel at Livermore, arriving much chilled. Roads very muddy. After supper talked with Prof. George and got better directions as to where he and Crawford found fossils in the Lyons.

Livermore, Colo., Aug. 12, 1908.

Bright, warm morning. Roads muddy. Started at 7:30. Past l. s. ridge N. of Deadman Butte, after photographing the ridge from top of Butte. On stream ^{N. of ridge} found typical purple conglomerate of Fountain. Above it on N. slope of l. s. ridge, dipping S. under the l. s. is a mostly thin-bedded, cross-bedded, fine-grained sandstone of uniform red color, exactly like the Lyons as it occurs above the l. s. at Owl Canyon and elsewhere. Took photo of the ridge from

west, with l.s. at top and picture of eroded
 crossbedding from top of ridge looking east.
 Then proceeded on N. to where Ten Mile creek
 breaks out of the granite. Here at top (N.) of
 granite occurs a gneiss series with
 dip vertical, strike E-W. parallel with
 granite - Fountain contact, and interstratified
 with well crystallized. Barely above
 the granite is an obscure outcrop of pure
 white or light gray limestone. In creek
 bed section begins as follows above
 granite: (estimated only) dip N. about 10°
 covered about $\frac{100}{ft}$

Fine grained thin bedded light pinkish s.	3
Mottled dark red & white coarse ss	$3\frac{1}{2}$
Dark red thin bedded shaly ss	5
alternating thin & thick bedded ss. thick beds darker lighter than thin bedded	80
(fine to coarse grained - midway is a zone of like Lyons - calcareous a little below middle)	
covered over a creek bottom & slope	50
Below above series to E. - calcareous s.s.	30
Below that congl. with calcareous ss. about.	50
red pink & gray ss. not calcareous underlaid by ^{small spots of} granite	10 120 ft.

The bluff to the S.E. is about 2500 or 3000 ft high, attenuating red s.s. & congl., mostly with pinkish color characteristic of the Fountain at Left Hand, but some pure reds like Lyons at Owl canyon.

The upper part are strong l.s. beds.

The cliff forms several benches.

The upper 50 ft capped by strong l.s. is particularly Lyons like. The l.s. contains crinoid stems and *Productus* cora.

after lunch we drove to Owl canyon. S. of the canyon the 2 upper benches are capped by l.s. & between them and below the lower one are thick bands (¹²⁻¹⁵~~10-20~~ ft.) of thin bedded, pinkish, crossbedded s.s. just like the s.s. overlying the ^{upper} l.s. which Barton calls the Ten Sleep. Here, as on Ten Mile Creek, the Fountain is not nearly as conglomeritic as it is southward. The Carboniferous escarpment, except for the l.s. beds is just as in the Bellevue fold above the Fountain. Below the limestone the sandstones and conglomerates are decidedly darker, less of a pink and

- Gray ss., not quite so friable as last (?)
massive, strongly jointed vertically
in places, forming base of vertical cliff 26 ft
- Yellow ss., ripple-marked, forming upper
part of face of cliff, less massive
and sloping away above 37 ft
- Clay - covered in most places 3 ft
- Blueish l.s., hard weathering rough and rather
conchoidally on surface as if composed
of flattened conical bases an inch in diameter 1 ft
- Clays and limestones interstratified 45
- Gray friable ss 8
- Clays, limestones & sandstones, greenish
and reddish below, more grayish above
all crumbling readily about 100 ft
- "Dakota" basal ss. & congl.

Dakota medial shales, black below, light
brownish above with *ostrea* & *Duoceras*
in upper half

" upper ss., rather slabby

Hibberson:

King table Mt. the Jurassic strata
begin away for miles eastward in
bluffs much resembling the Chalk Bluffs

~~Region in the Tertiary formations further east.~~ It closed up in afternoon. We found no fossils. Reached Livermore at 5:10 p. m.

Livermore, Colo., Aug 14, 1908.

Bright morning but shows tendency to cloud up. Left for Ft. Collins at 7 a. m. Have been staying with G. W. Rawer at the Rawer Hotel. Just E. of hotel on hill Lyons rd. beneath the carboniferous l.s. has dip of cross bedding strongly S. E. while 100 yds beyond it dips N. W., with a covered zone between. At mouth Owl Canyon drainage the light gray s.s. above the pink ~~is~~ is not so whitish and the yellow s.s. not so yellow. The thin l.s. above the yellow still persists. In the Lyons escarpment S. of Engleide where the ridge disappears with change of dip to S. and strike to W., the l.s. bands have thinned out greatly and the 75 ft. of Fountain typical congl. & coarse s.s. exposed are sharply divided from the

pinkish + white ss. of the Lyons, at
further d.

In ditch cut on N. side Poudre River
at base are exposed $\frac{1}{2}$ ft. bluish clay,
above are 6 ft or more l. s. in 10 inch
bands, above this $\frac{1}{2}$ ft rather coarse
light colored (slightly yellowish) ss., then
bluish clay like Pierre-massive - 20 ft
Sakota reddish congl. pebbles up to $\frac{1}{2}$ inch 10 ft
Nearly white ss. brown specks to top of cliff 20 ft
dividing line bet. ss. + congl. well marked
change from ^{nearly} structureless clay to congl. is very
abrupt, the congl. being laid on a slightly
uneven bed of clay.

In climbing face of cliff in Belleview
fold I lost my fountain pen. and took
balance of notes in pencil, afterwards
copying them. Reached Ft. Collins at
3:15 p. m. Left Ft. Collins at 4:05, arriving
at Loveland at 4:39 in rain, went to
Loveland Hotel. Raining hard at bedtime.

Lowland, Aug. 15, 1908.

Started west at 7 a. m. with team from Branson + Charlton's stable. Road quite muddy. Reached gulch where Home Supply and Handy dittoes leave foothills at 8:15.

at top of Lykins red beds are massive pink sandstone, overlaid by slightly pinkish but nearly gray massive transition (in color) beds, all weathering roundly, above which is a gray slabby sandstone weathering in low angular blocks and benches, some layers pitted by dissolution of greenish clay or lime nodules $\frac{1}{4}$ to $\frac{1}{2}$ inch ~~see~~ in diameter. Yellowish sandstone ^{and one foot nodular limestone} found above this at Boy Eder is missing here. Above this is a hard, bluish, thick bedded limestone, outer surface with calcite streaks probably 20 ft. thick showing in several ledges in talus slope, overlaid by

another bench of the angular grayish sandstone, 15 ft. or more. Next is another limestone like that at Boy Elder but no thin nodular one. Above limestone is a thick bed of greenish, very fine grained sandstone, then variegated clay with a medial lighter colored ^{part} sandstone well exhibited at mouth of tunnel through "Dakota" ridge on South side of valley.

Base of Dakota not conglomeratic but massive. Above basal sandstone are alternating thin bedded ^{brown light colored} sandstones and black shales, latter for 25 feet or so, then black shales above, the basal shaly & sandstone beds containing numerous plant fragments. Lower half of medial "Dakota" shales are nearly all black, brown sandy seams coming in gradually, the latter in the middle part containing *Orthis* & *Ducera* as elsewhere, upper third very sandy, passing

gradually into the much weathered
upper sandstone containing plant
stems, perhaps seaweeds.

Mountain mahogany about as
abundant on sandstone ridges here as
at Owl Canyon.

Left Ft. Collins on 2:39 train,
reaching Boulder at 4 p.m. Has
been clear, ~~with~~ roads drying
rapidly.

Longmont, Col. Sept. 30, 1908.

Left Boulder at 5⁰⁰ p.m. reached
here on time. Went to Imperial Hotel
and was in bed before 9 p.m. Kerosene
lamps in rooms, but good room and
fair bed.

Lyons, Col., Oct 1, 1908.

Arose at 7 a.m., shaved and
had breakfast. Called on Bryerton &
Wheeler, failed to find others.

Left for Lyons on 10:05 train B. & M.
Reached Lyons at 10:30, went to Burling-
ton Hotel, changed clothes & worked ^{on food} ~~with~~
along a syncline, then to east over an
anticline. Many pinon jays along the
syncline. After dinner started up
S. fork of N. Train on horseback,
horse from Bartwell's. On contact of
Fountain with granite several chestnut
backed bluebirds. Very hard work on high,
steep ridges. Mapped about 12 square
miles today. Reached hotel at 6 p.m.,
very tired. Several buzzards and sparrow
hawks seen.

Lyons, Oct. 2, 1908.

Started for Rattlesnake Park on
horseback at 7 a.m. At Little Thompson
Fountain rests on gneiss and all through
the region up creek gneiss is inter-
stratified with granite, though south-

ward the Fountain rests on red granite, ~~at~~ ~~but~~ along road just before leaving the creek and again on the hill just south of Rattlesnake Park are small outcrops of Fountain conglomerate dipping E. into the gneissic ^{met.} They are only a few ^{square} feet in area. Could not determine whether they are left in such positions by fault or fold.

On W. side of R. Park, which I reached at 11 a.m., the granite contains large bodies of white quartz. The W. or west side is gneiss. The Fountain occupies E. side of Park, dipping ^{upward toward side} ~~very steeply~~. Killed at Rattlesnake just S. of Rattlesnake Park, in Dry Hollow. Left Park at 2 p.m. Strata badly twisted where Dry Hollow enters Little Thompson and below there for some distance. Reached hotel at 6:15, very tired and sore. Here as elsewhere Lyons is sharply differentiated from Fountain in both color and texture, in the escarpment. Fountain contains

some limestone bands.

Lyon, Cal., Oct. 3, 1908.

Started north at 6:45 on foot. Hot
work climbing the ridges, but cool breeze.
Worked N. and then E. over Lyons s.s.
ridge, through Noland and then over
the "Dakota" ridge. Very smoky day, but
clear. The s.s. in Lower Lykins appears
to blend with the Lyons by disappearance
of the intervening ^{interval, red} micaceous ^{pricks} s.s. I see
no nonconformity. Base of "Dakota" is
a beautiful conglomerate 15 ft. thick, reached
hotel at 11:30. Started E. horseback at 12:30.
Hygiene s.s. is faulted 1500 feet, about a
mile S. of St. Vrain, S. side of fault thrown
to W. & shoved N. ~~It~~ clouds began
to settle down on the mountains at
10 a.m. and it was sprinkling at
intervals all afternoon, raining in
earnest at 4:30 p.m. Returned

~~to~~

to the hotel at 4:15 expecting to take the train and learned that there is no train until Monday. Saw mt. bluebirds east of Rabbit Mt. meadow larks singing.

Lyon, Col. Oct 4, 1908.

Drove from Lyon to Longmont in cold east wind and caught train to Boulder.

October 6, 1908

Left Boulder on Interurban car at 2:30 p.m. Left Denver at 5 p.m., dined on train, reached Barr at 8:15, half an hour late. Got a room at the new "depot cafe".

Barr, Col., Oct. 7, 1908

Bright, cold morning arose at 6 a.m. Started W. on foot at 7:15. At Barr the pure white Laramie s.s. with iron concretions out-

rocks overlaid by granite-quartz
debris, with s.s. fragments more common
to the westward. Some of the granite
boulders are a foot in diameter.

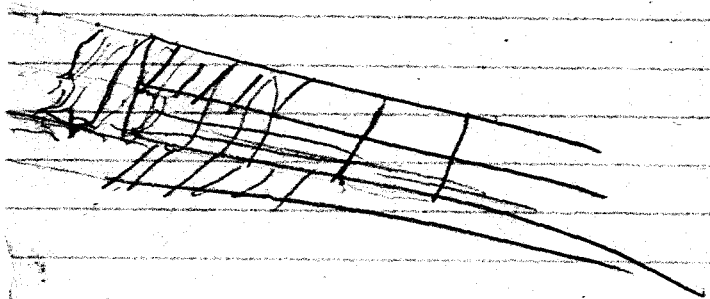
In bluffs N.E. of Round Butte a massive
s.s., light colored but not white, which
I supposed Laramie, proved to contain
Fox Hills spp. about half way up. It
was about 40 feet thick at east end,
underlain by black (Pierre?) shales and
unconformably overlaid by a very
hard pink to red conglomerate, mostly
granite pebbles etc up to half an inch
in diameter, looking just as portions of the
Mountain except for larger sandstone
fragments contained up to 2 ft diameter.
The F. H. s.s. thins out to the west and
then the conglomerate is eroded away
leaving the Pierre exposed toward
the foothills. Reached a ranch ^{on Dec 10} and got
some alkali water out of a spring at
1 p.m., then climbed the foothills and
went N. along "Dakota" ridge to where the Tertiary
transgresses its edge. Here the "Dakota" has an

E. dip of about 25° . The actual disappearance of the other cretaceous formations under the Tertiary could not be observed. started back at 8:30. The gulches south of the Tertiary bluffs expose what appear to be worked-over Tertiaries. In some instances the lower exposed stratum is a conglomerate composed of the worked-over ^{red} Tertiary conglomerate, and is covered by clay indistinguishable from the original Brule clay. In other cases the bottom exposure is a conglomerate of Brule clay probably an inch or so in thickness. In one gulch near foothills is a Fox Hills or Pierre exposure with southerly dip of 18° . My impression is that practically the whole area W. of Spottwood creek in Livermore quadrangle and N. of the bluffs N. of Round Butte should be assigned to the Tertiary, and indeed on east nearly to Lone Tree creek, as I found Laramie only a few short distance W. of that creek. Saw 5 or 6 coyotes, 2 white-tailed jackrabbits and numbers of cottontails. No sheep and but few cattle. Reached hotel at 9:20, worn out. The last few

miles I had to lie down several times for a moment or two.

Barr, Colo., Oct. 8, 1908.

Left Barr at 9:45, about 2 hours late, reached Denver at 12:15, on N. P. Rode part of way with Judge Southard, then lunched with him at University Club. Bought the 2 p. m. Peter Urban car to Boulder, arriving at 3:20.



© We [unclear]

X 1.2 ft
 2.00 yds
 3.00 yds
 4.00 yds
 5.00 yds

2.00 yds
 3.00 yds

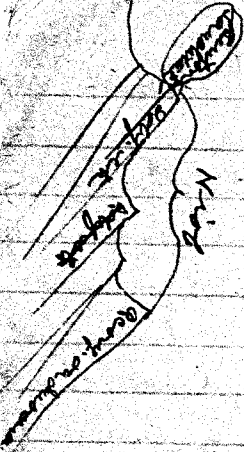
2.00 yds
 3.00 yds

Continued

of part

Wind

Recent deposit
 recent deposit
 recent deposit



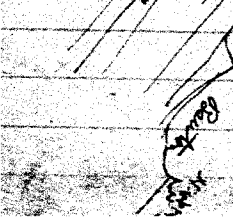
Recent deposit
 recent deposit
 recent deposit

31.74
 18.74
 16.74
 14.74
 12.74
 10.74
 8.74
 6.74
 4.74
 2.74

Recent deposit
 recent deposit
 recent deposit

Recent deposit
 recent deposit
 recent deposit

Recent deposit
 recent deposit
 recent deposit



Recent deposit
 recent deposit
 recent deposit