

Junius Henderson
Field Notebook
No. 10
1921-1923

Junius Henderson
Boulder, Colo

Note Book

No. 10. - 1921 - 1923

Sage Mts., Tuesday,
July 26, 1921.

Bright, breezy morning.

Drove S.W. & W. across Bear River.

Sta. 379^a, 10 mi. out, slough on W. side Bear River Valley, *Apleta* abundant, *Lymnaea* and *Physa* common, one small *Planorbis*, Utah, just over the line.

Sta. 380, aspen grove about 12 mi W. of # 379, in gulch where road leads down to Bear Lake.

Drove through Garden City, St. Charles, Paris, etc., to Montpelier, Idaho, and camped on the city auto camp ground back of an old school house.

Idaho
Montpelier, Idaho, Wednesday,
July 27, 1921

Bright warm morning,

Started N. from Montpelier

Sta. 381, roadside ditch 2 mi. N.

of Montpellier. *Lycunaea* abundant, also
apple. *Physa* common, 2 spp. *Succinea*,
small *Planorbis* abundant

Moll. Sta. 382, shrubs & small aspens,
dry hillside facing N. just over the hill from
Montpelier to Soda Springs, 16 mi. from
Montpelier. *Vallonia*, a few; *Vitrina*, 1.

Moll. Sta. 383, very small, vegetation-
choked rivulet 1 mi. W. of * 382. *Lycunaea*
abundant, *Psidium* common.

Camped in municipal camp ground
at Lava.

Partly cloudy, windy afternoon.

Lava, Ida., Thursday,
July 28, 1921.

Bright morning.

Moll. Sta. 384, bank of Port Neuf River,
2 mi. below Lava, *Filaminicola*, *Physa* and
Succinea abundant. *Oreohelix* scarce under
rosebushes.

Camped at the Municipal camp ground
at Pocatella.

Pocatella, Ida., Friday,

July 29, 1921.

Bright and hot all day. Remained in camp except for a short time in afternoon, when Mr. Anderson, secretary of Chamber of Commerce, took me to meet President Frazier and examine the Idaho Technical Institute.

Pocatella, Ida., Saturday,

July 30, 1921.

Bright hot morning.

Moll. sta. 385, 11 mi. N. of Pocatella, roadside slough, Lymnaea & Physa abundant, just south of Fort Hall Reservation store.

Moll. sta. 386, at auto bridge over Snake River, Fifth, Ida. One Fluminicola. One valve of Anodonta on bank.

Moll. sta. 387, ditch 7 mi. N. of Idaho Falls. Physa common, but hard to get.

Moll. sta. 388, slough at Snake River Bridge just N. of Laramie. Physa & Succinea scarce, Lymnaea abundant.

Anderson, of Postville Chamber of
Commerce, says old Fort Hall, from whence
mosses were published years ago, is not
the Fort Hall of today, but 25 miles distant.

Hot and bright all day.

Camped in city auto camp ground at
Reynolds - good shade, wood and water - best
we have had except Montpelier.

Reynolds, Idaho, Sunday,
July 31, 1921

Cooler. Windy afternoon.

Remained in camp all day.

A little rain in evening.

Reynolds, Idaho, Monday,

Aug 1, July 31, 1921.

Bright, cool morning.

Sta. 389, sloughs along Tetan River just
N. of Reynolds, along highway. *Physa*, *Succinea*,
Planorbis and *Lymnaea* abundant. Muddy,
shallow, devoid of vegetation, probably go
dry in late summer. One aplet. (see below)

Lots of sloughs along road to
St. Anthony

Sta. 390, roadside sloughs with no vegetation except algae, 2 mi. S. of St. Anthony. Lymnaea abundant, Physa & small Planorbis scarce, 2 *L. appressa*.

Sta. 391, Lava rocks free from vegetation in river at St. Anthony. Lymnaea ^{partly} abundant, Physa common. The stream appears from the map to be Henry's Fork.

Sta. 392, large ditch free from vegetation, 2 mi. N. of E. of N. from St. Anthony. Lymnaea abundant, Physa scarce.

Sta. 393, ~~lava rocks~~ ^{Henry's Fork} ~~along~~ small boulders, 13 mi. N. E. of St. Anthony.

We turned N. over ridge ^{near} at Chester. This Sta. is just after turning off. This is the Oro, or sand break, road.

There may be two species of Physa in the lot from Sta. 389. I saved anatomy of both.

We made a dry camp on the slope where we first encountered pines in starting over the ridge, 21 miles from St. Anthony.

New Blackstone ~~to~~ chieftain casing on left front wheel today - Speedometer 1491.

Partly cloudy afternoon

Big Bend Ridge, Tuesday,
Aug 2, 1925.

Partly cloudy morning.

About 4 mi. from camp we collected plants and in another mile passed over Sedoras Pass, at 6200 ft. Plants about 5000, probably

Moll. Sta. 394, aspen-pine forest about 1 mi. N. of Sedoras Pass. *Zonitoides*, *Encrinurus*, *Vallonia*, *Vitrea* and 1 adult *Orchelimum cooperi*? about 1 mi. S. of Elk Mallow, where there is a good well. Speedometer 15-12.

Moll. Sta. 395, lake choked with vegetation at 15-18x. *Pisidium* scarce.

Moll. Sta. 396, Henry's Fork, where the road reaches it at # 15-20 Speedometer. *Planorbis* small + abundant. *Lymnaea* scarce.

Moll. Sta. 397, aspens just S. of Henry's Lake, about 1 1/4 mi. from the Park. *Orchelimum* abundant, *Vallonia*, *Pupella*, *Zonitoides* etc.

Moll. Sta. 398, Madison River, 6 miles within the Yellowstone Park from West

Entrance, clean gravel bottom. *Lymnaea* abundant
Physa rather scarce.

Ran a couple of miles farther and
camped on Madison River.

Yellowstone Park, Wednesday,

Aug. 3, 1921.

Partly cloudy, cool.

Drove to West Thumb of Yellowstone
Lake then south and camped on Dog
Creek near Lewis Lake.

Found no mollusks in Firehole River,
or Isa Lake. Did not examine any other water,
except where we reached West Thumb and no
mollusks there. Isa Lake covered with
water lily pads, many in blossom.

Rained a little at evening.

Moran (Jackson Lake) Wyo.

Thursday Aug 4, 1921

Drove to lake in forenoon

Moll. Sta. 399. Pools along a small
stream 2 mi. N.E. of Moran. *Lymnaea*

abundant in stagnant places. *Physa*
scarce. None found in moving water. ^{alt. 7000}
Sta. 400, edge of mixed aspen-conifer ^{ft}
forest, open & dry, Pilgrim Creek, 7 miles
N. of Moran by road, alt. 7000 ft.

Big dam has raised the level of Jackson
Lake many ft. Water being drawn off for
irrigation. Found no mollusks in it.
Clear most of day.

Yellowstone Lake, Friday,

Aug. 5, 1921.

Clear, cold morning. Cloudy afternoon.
Drove to Lake Junction & camped in
public auto camp.

Right front casing, Pennsylvania Vacuum
Corp., put on at Rock Springs, has been
developing a bad transverse crack. Took it
off and put on a Fish non-skid here at
camp. Speedometer 1729.

Mammoth Springs, Saturday,
Aug. 6, 1921.

cool, cloudy day.

Drove past Tower Falls to Mammoth.
Found no mollusks on the way.

Mammoth Springs, Sunday,
Aug. 7, 1921.

clear and hot.

Visited the Springs & terraces.
Had broken front spring replaced
with a new one.

Mammoth Springs, Monday,
Aug. 8, 1921

Bright and warm.

Drove through Norris Jc., Canyon Jc. &
Lake Jc. and camped near Sylvia Pass.
Cloudy evening.

Sylvia Pass, Tuesday,

Aug. 9, 1921

cloudy, cool morning, sprinkling
at intervals.

Left the park via east entrance.

Moll. Sta. 401, N. fork Shoshone River,
3.3 mi. W. of Bady, Wyo., cottonwood grove.
Snails scarce.

Camped at Bady public camp ground.

Bady, Wyo., Wednesday.

Aug. 10, 1921.

Bright & hot.

Moll. Sta. 402, about 2 mi. W. of
Burlington (speedometer 1952), very small
ditch. *Lymnaea* abundant in water silk.

Moll. Sta. 403, larger algae choked
ditch half mile S. of Burlington. Larger
Lymnaea abundant.

Camped at Grebbell, on river bank.

Greybull, Wyo., Thursday,

Aug. 11, 1921.

Bright and very hot.

Fossil sta. 84, Sundance Jurassic, fine exposure N. of town, N. of shell creek. Gryphaea very abundant in lower third, Belemnites and Ostrea sp. in middle third. Upper third apparently barren. Morrison is also well exposed, as well as Dakota (very thin), Colorado + Montana, but found no fossils in those formations.

Shipped box No. 10.

Greybull, Wyo., Friday,

Aug. 12, 1921

Somewhat cooler, bright, with breeze.

Well. Sta. 404, ditch at Ten Sleep.

Physa, 2 dead shells. I saw two young examples.

Road from Ten Sleep to No Wood very hilly - short steep hills.

Bumped near No Wood.

Rained in evening.

No Wood, Wyo., Saturday,
Aug. 13, 1921.

Bright morning - cool breeze.

Ran about 2 miles and car gave out.
One spark plug and two wires gone.

Fossil Sta. 65, Lower Sundance Jurassic
W. of road about 3 or 4 mi. S. of No Wood,
where road starts over the divide.

Belemnites common. A few Camptonotus
and large Ostrea fragments. Rests on
blue water, with massive s.s. just below
Sundance.

Lysite Garage sent man to make various
repairs. Rained in afternoon & evening
camped at Lysite. ↓

Lysite, Wyo., Sunday,
Aug. 14, 1921.

Hot day. Sick and laid down all
day.

Loy-site, Wyo., Monday.
Aug. 15, 1921.

Bright, warm morning
Mollusk sta. 405 ^{catch} slough at south edge
of Riverton. Lymnaea abundant, small
Physa common, one or two Aplysia.

Moll. Sta. 406, slough on Lander road
3 miles S.W. of ^{Loy-site} Riverton. Large Lymnaea
& Physa abundant.

Moll. Sta. 407, sluggish stream 9 mi. S.W.
of Loy-site Riverton. Lymnaea, Physa, Succinea
and one small Planorbis - just E. of Arapahoe P.D.

Moll. Sta. 408, large slough just W. of
Arapahoe, Wyo., 10 mi. S.W. of Riverton & Physa
common.

Camped at Lander tourist camp ground.
Road from Ten sleep to Lost Cabin very
rough and hilly, from Lost Cabin to Loy-site
good, Loy-site to Riverton fine, Riverton
to Lander good.

Rained in evening.

Lander, Wyo, Tuesday,
Aug. 16, 1927

Bright morning.

Drove S. on Laramie road toward
Hailey.

Fossil Sta. 66, about 100 to 150 ft.
above upper Dakota ss., 21 mi. from
Lander. Fish scales common with
crushed *Inoceramus* fragments less
common.

Sta. 67, E. of 66, from 22 to 22 mi. S.E.
of Lander (7 to 8 mi. N.W. of Hailey) ^{near} top of Frontier
formation (Lower Mancos). Locality from which
Phil Andrews obtained a small collection
forms some time ago.

Sta. 68, Lower Sundance Jurassic, 16
mi. S.E. of Lander. Shell fragments abun-
dant in the rock, but hard to get out.

Moll. Sta. 409, slough at stream 10 miles
S. of Lander. *Lymnaea* abundant, *Physa*
not abundant.

Moll. Sta. 410, small pool at camp.
Physa & *Lymnaea* abundant.
Banded at Waltham.

Boulder, Aug. 17, 1941
~~Waltham, Wyo.~~ Wednesday

Started for home at 10:30 a.m.

Hot day.

Camped at Waltham at 6 p.m.

Waltham, Wyo., Thursday
Aug. 18, 1941.

Hot and windy.

Drove on at 7:30 a.m., and
camped about 10 or 12 miles S. of
Wheatland at 7 p.m., stopping
several times on account of tire
trouble and other repairs.

Near Wheatland, Wyo.

Aug. 19, 1941.

Drove on at 7 a.m. & reached
Boulder at 5 p.m.

Owl Canyon, Colo.

Apr. 22, 1922.

Drove to Owl Canyon with Prof. George and his Colorado Geology class.

In one of the Upper Fountain conglomerates at its base we found fragments of l.s. enclosed.

A few feet of conglomerate at very base of the Fountain contains Mississippian chert pebbles up to 2 or 3 inches in diameter, thoroughly waterworn.

In about the middle horizon E. of the Canyon we found spiral algae and a few gastropods, apparently *Valvata* and *Planorbis*. Beautiful cross bedding in the sandstone, very regular and even, and in the limestones very irregular.

Boulder, Colo., June 7, 1922

Left Boulder at 4:45 p.m. in car driven O. G. McDonald, with Prof. J. A. Keyte, Ira M. Hicks, David B. Miller. at dusk camped on Roche la Poudre just N. of Bellvue. Hot day.

Bellvue, Colo., June 8, 1922

~~At~~ Moll. Sta. 411, roadside slough just inside the foothills at camp. - Logansport at Pine Ridge we found an outcrop of weak concretionary sandstone north of the road, containing about the same fauna as the Hygiene sandstone, but poorly preserved. Saw 4 antelope in one bunch.

Camped at Medicine Bow at 6 p.m.

at bridge just N. of town white, soft Kiobrara chalk is exposed, overlaid by darker material, some weathering to yellow. Fish remains at bridge. Dip 11° S. 45° W.

Hot, bright day.

Medicine Bow, Wyo.

June 9, 1922

Cloudy morning, soon clearing and hot. A mile up ~~east~~ ^{east} ~~higher~~ road near top of hill, hard ^{shale} lime horizon well shown in the Benton, with fish scales.

Rawlins, ~~to~~ Wyo, June 10, 1922

Reached Rawlins at 9:30 a.m., shipped two boxes of fossils, and left at 11 a.m.

Road for 25 miles N.W. pretty good. From there on past Lost Soldier oil field it is very bad, and much of it farther on not good, but some long stretches over ridges very good. The last 30 miles, from Hailey to Rawlins, excellent. ~~to~~

Reached ~~Rawlins~~ ^{Lander} at 8 p.m. and got rooms at Fremont Hotel.

Cooler than last few days.

about 130 mi. from Rawlins to Lander.

N.H. Browne called at hotel and talked fossils - county surveyor.

I believe we crossed Madison Mississippian, and surely crossed Mississippian, but found no fossils, except one poorly preserved pelecypod in the latter ^{also possibly} ~~possibly~~ ^{over} ~~possibly~~.

Then we followed down slope, and over W. side Crooked Canyon (I suspect that I labelled these E. side) near mouth, where, just above the Ten Sleep cliffs we collected *Orbiculoides utahensis*, *Sclerodus mercurii* Newberry (fish teeth), and *Helodus subpolitus* Branson (fish teeth), from ^{Ember}.

The Ten Sleep is a strongly cross-bedded sandstone forming a vertical cliff just within the mouth of Big Popo age and Crooked Canyons, perhaps 40 or 50 feet high, with a white quartzite band near base.

Returned to camp over various ^{old} terminal moraines at 7 p.m. The moraine extend to the edge of the plain.

Balsamorhiza sagittata abundant, but no *Oxobolus* found.

Robin and Yellowthroat sang a duet at camp.

Hot, bright day. Woodticks abundant, mosquitoes few.

Big Popo agile, Monday
June ~~19~~ 12, 1922.

Keyte and I went to mouth of Canyon, climbed out on E. side of brooked canyon, continued S. to Enterprise ditch and followed it to where it crossed the S. branch of brooked canyon creek, perhaps 2-3 mi. S. of River, and about 7 miles from camp by the route we followed ~~to~~ travelled. There we collected Spirifer, Composita, Productus, etc.

washed from the Eubar Pennsylvanian red shales. In jumping the wide ditch I badly sprained my ankle, so started for camp slowly, using two sticks for crutches, reaching camp at 7:30, much used up by fatigue and pain.

Keyte remained for a while, catching up with me at 4 before I reached the river. He climbed out on the N. side, collected Spiriferina pulchra, etc., from the Eubar, and reached camp at 8 p.m.

He heated water for my foot, and did a fine job of bandaging.

I teased a big bullsnake and got him to hissing. He had developed a hiss like the rattle of a rattlesnake, but not so loud or sharp.

A very hot day.

Big Popo Agie, Tuesday,

June 13, 1922

The boys returned to camp at 7 a. m.

My ankle so badly swollen I cannot get my boot on or walk, so am compelled to remain in camp. The other 4 started up the cliff N. of the river, to examine all the formations from Cambrian to the Emboss

at 5 p. m. McDonald took me to ^{Lander} Denver in his car, got me a pair of crutches and we went to the Noble Hotel, the best and highest priced in the town, an excellent hotel. Had a doctor strap my foot & ankle. Badly swollen & sore.

Lander, June 14, 1922

Took B. & N. W. train at 8:45 a. m., reached Casper at 3 p. m., and went to the Hanning Hotel, best in town to await

the 8:35 Burlington (C. & N.) for Boulder

Boulder, Colo., Monday

July 3, 1922.

Started with Earl G. Smith in
gliver, with camp outfit, at 9:30
a. m. Speedometer 246 miles.

Made several detours; passed through
Ft. Collins, and camped at S. end of
Douglas Lake (Res. No. 10), 7 mi N. of Ft.
Collins. Hot day.

Hygiene ss. exposed along E. side of
lake, and deeply cut by irrigating canal
toward head of lake. From typical
Fossil Ridge concretions we collected
Jucoceramus oblongus, etc., *Anomia*
raetiformis, *Pteria linguiformis*, *Chaetetes*
dimissus, etc. six light to the east.

Saw a red winged blackbird chasing
a striped gopher across the road.

Can hear several cock pheasants
about camp.

Rocky Ridge, Tuesday,
July 4, 1922

Broke camp in morning and ran back S. to southern end, where we collected from typical exposures of Hygiene sandstone S. E. and E. of Rocky Ridge Reservoir No. 1. Here, as at Douglas Reservoir yesterday, the fossils were mostly from the concretions of ~~the~~ near the top of the bluff.

~~Later in~~ Afternoon we drove to Ft. Collins and filled all canteens. Very hot - reported at 105° in the shade.

Then drove north and camped at lake S. E. of Round Butte.

Terrific wind and rain storm about sundown - blew our tent down.

Round Butte, Wednesday,

July 5, 1922.

cooler with rain at noon and at

intervals in afternoon.

Collected in Hygiene sandstone where it is turned nearly on end just S. of the Butte ^{W. of Lake}. Here the fossils are mostly in one of the lower concretionary bands, but not the lowest.

John Graham, ~~of~~ who gets mail at Barr, but owns a ranch N.W. of Round Butte and is camped at the spring east of the Butte with a bunch of sheep, visited camp in evening with a boy and brought a specimen of *Scaphites nodosus*.

Wellington, Colo., July Thursday
July 5, 1922

Cloudy - cold wind soon arose and continued nearly all day, with rain at intervals, drove to a small butte N.W. of Round Butte, in Sec. 12, T. 11 N., R. 69 W. It is Pierre shale with thin sandstone layers.

Then drove to Wellington and

after driving N. & E. returned to
Wellington, shipped two boxes of
fossils, and camped in the municipal
camp ground. Cool evening

Wellington, Colo., Friday,
July 7, 1922

Bright morning, soon getting hot
drove $4\frac{1}{2}$ miles N. and $\frac{1}{2}$ mi. E.
to a low butte at edge of high
ground. Visited this station once before.
Stal. deep gully in alluvium cuts into
about 60 or 70 feet of soft, very massive
ss., non-fossiliferous and free from
concretions. This looks ~~just~~ like
the Milliken ss., but fauna lower.
A few above this softer ss. contains
fossiliferous concretions. From one we
broke ^{many} several ^{maxillae} of *lingulas*, also *Telling*,
gastropods, etc., about 15 or 20 ft
above the massive ss. ^{two} One *Verrilla*
~~seen but broken up and not~~
obtained.

about 5 ft. above Mastra horizon
concretions contained only numerous
Veniella humilis

Sta. 3 at same horizon about 100 yards S.
found *Veniella*, *Oringala*, etc., scarce, in
concretions, and on the surface a highly
wind-polished fossil log, which may have
been let down in the weathering of Eocene
formations which must have once covered
the region, as granite boulders, etc.,
also lie on the surface

Sta. 4, July 7, 2 or 3 ft. above
horizon of Sta. 1, and 150 ft. E. of
Sta. 3.

Sta. 5, near top of small butte, 50
or 60 ft. above Sta. 4 & E. of it, *Halymenites*,
Veniella, *Bucellaea*, *Pteria*, etc. The forma-
tion is rather soft, yellowish sandstone
all the way up, with a little shale.

This locality is $4\frac{1}{2}$ mi. N. and
3 mi. E. of Wellington, N.W. 4 Sec. 7, T. 9 N.,
R. 67 W.

Grove S. to road 1 mi. N. of
Wellington then 3 mi. E. to

Sta. 6, 1 mi. N. & $3\frac{1}{4}$ mi. E. of
Wellington, Sec. 30, T. 9 N., R. 67 W.,

Same horizon as stations in sec. 7, concretions containing *Mastra*, etc., in abundance in softer, yellow interior of concretion, surrounded by a thick outer, darker colored shell. Could get none out. Got a few *Verrilla humilis* a few feet higher.

Sta. 7 - about $3/4$ mi. S. E. of Sta. 6, same horizon - *Pteria*, *Verrilla*, etc.

Sta. 8, $1/4$ mi. S. E. and about 25 ft. higher than Sta. 7.

Sta. 9, $1/4$ mi. E. of Sta. 7 and perhaps 25 ft. higher, soft yellow sandstone, ^{possibly} probably top of ~~Hillborn~~ ^{Fox Hill}, occupying the high ground E. of Wellington, perhaps due to erosion of overlying shale. This station is somewhat concretionary, concretions weathering into thin, irregular pieces. We found no fossils except *Halymerites* in a hasty examination.

Wellington, Cal., Saturday,

July 8, 1922

Bright, hot morning.

Drove $6\frac{1}{4}$ mi. E. and $2\frac{1}{2}$ mi. S. of Wellington. High mesa capped by a hard, well consolidated red conglomerate about 10 ft. thick, similar to that on mesa N.E. of Round Butte. Pebbles mostly less than $\frac{1}{2}$ inch, but many several inches and a few up to $1\frac{1}{2}$ ft. in diameter, all waterworn debris from the mountains and foothills. Probably Eocene.

Beneath the conglomerate is soft, light colored sandstone, with harder yellow effoliated coverstone. Obtained no fossils, ^{But in N. of here, fossils pass under it.} ~~concretions like those of~~ Sta. 9. ~~Either Top Hill or Saramis.~~

Drove back nearly to town and took road running E. $\frac{1}{2}$ mi. N. of town, thence 3 mi. E. of town to a point half mile S. of 6, July 7

Sta. 10, concretions similar to those at Sta. 6 etc, with *Pteris*, *Vernicella*, etc, and *Teredo*-bored wood. S. of road

The Saramis ss. N.E. of here is

filled with iron nodules from a few millimeters in diameter up. They are thickly strewn over the surface of the slopes and large cut hills are composed of iron fragments. These are absent from the Fox Hills sandstones. I neglected to note that $\frac{1}{2}$ mi. S.E. of the conglomerate here mentioned in this morning's notes, the yellow concretionary ss. is underlain by thick clays containing numerous fragments of plants, & undoubtedly of Laramie. Three miles S. of the conglomerate butte the same sort of concretionary sandstone was found, and beneath it is clay and a thin coal bed, shown on the map.

The Tertiary(?) conglomerate could be seen from the big mesa, at various points to the northward.

Station 11, Laramie Cretaceous, 6 mi. E. and $\frac{1}{2}$ mi. S. of Wellington, ^{N. of road} ~~1/2~~ of road, a two foot bed composed entirely of *Astraea glabra*.

Sta. 12, Willaken sandstones W. of Sta 11, $3\frac{1}{4}$ mi. E. of Wellington along same road. *Bordinum*, *Scaphites*, *Pteria*, etc.

Very windy afternoon, especially
after 4 p. m., but calm after
sundown. Hot day and wind warm.

Wellington, Col., Sunday, July 9

Bright morning, cloudy afternoon sprinkling
at intervals, cool evening. Stayed in camp
all afternoon.

Wellington, Col., Monday
July 10, 1922

Partly cloudy morning, with cool
east wind.

Shipped a box of fossils.

Broke camp and drove $1\frac{1}{2}$ mi. S. and
 $2\frac{1}{2}$ mi. E. to

Sta. 13, Fox Hills Milliken ss., a few
concretions along road, with *Lingula*,
Bardina, *Mucula*, etc., scarce.

Sta. 14, $\frac{1}{2}$ mi. E. of Sta. 13, Milliken
concretions, *Bucellaea*, *Verrilla*, etc.

Sta. 15, Laramie cret., with *Ostrea*,
Corbicula and *Halysites* $2\frac{1}{2}$ mi.

E. of Sta. 14, There are three sandstone ~~beds~~ ^{layers} on the westerly slope exposed, the lowest containing the fossils, the middle one partly massive and white, partly thin-bedded and quite yellow. Covered zones of 10 to 15 ft. intervals. The highest is highly charged with iron nodules and slabs. The formation is predominantly shale. A broad valley separates this ridge from the Milliken ss. to the west, probably occupied by shales.

Sta. 16, 2 mi. S. and 2 1/2 mi. E. of Wellington S.W. of Sta 14, along road. Milliken concretions.

The ^{upper} Milliken is well exposed in hills about half or 3/4 mi. S.E. of Sta. 16, containing *Bucella*, *Verrillia*, etc., but we collected none.

Saw a hog nosed snake.

Drove to Windsor in afternoon and camped ~~with~~ in public campground in city park. Visited Geo. E. Osterhout and he took us in his car to the bridge at the bluffs about 4 mi. S.E. of town, Sta.

Sta. 17, Lower Fox Hills, below the Milliken ss., clay shales forming the bluffs with very little sandstone. *Veridilla* common in concretions or thin (4 to 6 inch) sandstone bands in the clay, also found 1 gastropod, 1 *Pholadomya* and 1 *Anatina*.

Sta. 18, the Milliken sandstone on slopes above the bluffs. *Halymerites* common, a few *Lunatia*, *Argostrea* and shark teeth. Here we find no *Veridilla* in the sandstone at all or the concretions, while they were abundant east of Wellington. In other words, while the sandstones east of Wellington appear to be Milliken, the fauna is not. The marine fossils extend to the top of the sandstones east of Milliken with no sandstones above ~~it~~ except the iron-bearing sandstones well up in the Lacramie shales.

East wind most of day. Quite cool in evening. Fine shade in campground. Took supper at Osterhout's.

Windsor, Col., Tuesday,
July 11, 1922

Bright cool morning.

In forenoon we collected shark teeth at yesterday's Sta. 18, in Milliken ss.

In afternoon drove with Mr. Osterhout and a Mr. Wilson to a point about 1 mi. S. of entrance to Spring Canyon, S. W. of Ft. Collins. Here in W. half of Sec. 3, T₄ S₁ E₁ N. R. 69 W., in lower Pierre shales, we found just east of the road some concretions containing *Baculites* *ovatus* and *B. ovatus*. Dip 22° E.

The Niobrara Benton and base of Pierre to the west as usual. Black, very thin bedded clay shales, weathering into small flakes at base of Pierre. Yellowish upper Niobrara forming an east-facing escarpment. Black ~~lime~~ shaly limestones of middle Pierre well exposed in several gulches. Lower Niobrara limestone forming a high ridge, but not well exposed - mostly covered with weathered fragments. ~~P₁ shales~~ ^{P₁ shales} not exposed on W. side.

of ridge. One thin l.s. in upper
part of Benton full of *Inoceramus lobatus*.
Black shales exposed at base of Benton.

Cold E. wind most of day. Sprinkled
at intervals all day.

Dined with Osterhout in evening.
was sick all evening.

Windos
Wellington, Colo., Wednesday
July 12, 1922

Hot, bright morning.

Drove to bridge above the one
visited Monday then S. E. to N. end
of bluff. Gulcher cut through lower
Fox Hills, shales predominating but
many ss. bands up to 18 inches thick.

Sta. 19 - In one ss. band we found
Lardium, *Pteria*, *Neotria* and fragments
of leaves of land plants - not named.
1 mi. E. + 3 mi. S. of Windos.

Sta. 20, Milliken ss. on bluff S. E.
of Sta. 19, plant stems (possibly young
Halymitis) or perhaps Bryozoa
Sick in camp all afternoon
cool breeze, but hot in sun

Windsor
Wellington, Colo., Thursday,
July 13, 1922

Very hot, bright day

Sta. 21, gullies 1 mi. S. & 1 1/2 mi. W. of Windsor, concretions in predominating shale, with some sandstone layers.

Sta. 22, bluff near bridge, E. of road 3 mi. W. of Windsor, concretions in soft sandstone, much like Milliken in color, but less massive and more shaley. Dip about 6° E.

Cornish, Colo., Friday,

July 14, 1922

Very hot, bright day, warm wind - rose E., then N. to Severance, then E. through Eaton to Cornish, on Crow Creek, about 16 mi. E. of Eaton. Camped near cottonwoods and willows along side of dry channel of creek just below the village.

Sta. ²³ ~~2~~ ¹⁸⁷⁴ ~~2~~ mile or more below the Cornish P.O. is a white ss. visited by me

years ago. Just above it to the north is a 6 inch stratum composed of corbicula of 2 ^{small} species. Just above it about 2 or 3 ft. another stratum is composed of a larger species of corbicula and another composed of *Astrea globosa*. Near E. bank of creek.

Sta. 24. 1 mi. S. of Cornish, just N. of ranch house. Corbicula, large

Sta. 25, about 1/4 mi. E. of Sta. 24, near crest of hill; about 10 or 15 ft. above #24 *Anomia micromma*, *Astrea*, etc. This horizon extends for a long distance along the E. edge of the valley. Bone in core abundant.

Hard wind in evening. Very warm night.

Cornish, Colo., Saturday,

July 15, 1922

Very hot & bright, with warm, dry west wind.

Collected more along the horizon of Sta 25 including *Neberia* and *Corbicula*

The white ss. near Sta 23 contains many iron nodules as N. E. of Wellington, etc. and there is a great deal of iron

in the shales all about here
cloudy latter part of afternoon.

Cornish, Bob. Sunday,

July 16, 1922

boiler and very windy all day. Stayed
in camp. The village consists of about
a dozen buildings, including a store.

The channel of Crow creek is here dry,
as usual. Some of the cottonwoods
growing in and at the edge of the channel
are 2 1/2 and 3 ft. in diameter, the
willows smaller.

Heavy wind & hard thunder shower
about dark.

Cornish, Bob., Monday,

July 17, 1922

cloudy, misty, cool morning.

Drove several miles S. No exposures.

Have seen many white-tailed jack
rabbits and cottontails ever since leaving

Ft. Collins - open plains, no sage brush.
Here, same sort of country, saw 3 black
tailed jack rabbits within $\frac{1}{4}$ mile. Only
bush-like plant anywhere is yucca.

male lark buntings in flocks. Arkansas
flycatcher, mockingbird, browne thrush (2)
sharpshinned, swainson, sparrow and
marsh hawks, mourning dove (abundant)
and meadowlarks at Cornish. Just N. of
village flock of 25 magpies, ^{red} flocks and

Drove N. on main road up left
west side of creek about 8 mi. to where
road crosses creek above Foster, ~~to~~

Sta. 26, Laramie Cret., a corbula
horizon along east side of valley and 3
ft. above it a Corbicula horizon.

Sta. 27 - 200 or 300 yds S. of Sta. 26,
and about 6 or 8 ft. higher, another Corbicula
horizon. A few feet above this is a rem-
nant of conglomerate probably Eocene,
from which perhaps, ^{some of} the quartz and
other mountain debris scattered over the
country is derived. Pebbles mostly
under $\frac{1}{2}$ inch, none over 2 inches in
diameter.

Close to the road, E. of Sta. 26, is

a very soft ss., whitish with iron stains.
Above this conglomerate occurs in the
roadway cut, very much cross-bedded,
composed of granite debris and clay.

It may be an old Pleistocene or Eocene
stream bed running N. or S., as it is
N. of the one first mentioned. It is soft,
with some lime. The presence of the
mountain debris as the principal con-
stituent suggests deposition ^{at beginning} ~~in~~ of
Eocene time, but it may have been
derived from the weathering of Eocene
conglomerates in Pleistocene time.

It is not on high ground - not more
than 25 ft. above present creek bed,
half way up the first slope of the
valley.

Sta. 28, Laramie cret., across creek
opposite Briggisdale - *Corbicula* & *Ostrea* ^{No *Ostrea* collected}

Sta. 29, over the hill a few hundred yards
N.W. an *Ostrea* horizon of peculiar large
oysters is capped by a 2 ft. ledge of
small *Corbiculae* perhaps *C. macropustula*
The oysters at Sta. 28 are above the *Corbicula*

S. of road (S. of Sta. 28) in the bank
of a big canal, is a very soft fine, white
sandstone, strongly cross-bedded, dipping

at a low angle N. E.

This and other canals along the creek are not warranted by any possible seasonal flow of Brown Creek or possibility of storing water in reservoirs here ^{water expected} from Laramie river.

Returned to camp by road on west side of creek. A great deal of s.s. of Laramie age, strongly crossbedded and irregular, S.W. of the place above mentioned.

Bright afternoon, with cool breeze.

Bonish, Col., Tuesday,
July 18, 1922.

Foggy morning, soon clearing to a bright day.

Drove half mile or so E. of Bonish to same locality (N. of road) where Butters and I found so many *Melanias* about 10 years ago.

Sta. 30, along gentle slopes extending northeasterly for half or 3/4 mile. *Melania wyomingensis* abundant, *Melania* sp., *Campylaea* or *Viriparus* spp., *Talotona thompsoni* (Fair), *Anomia microneura*, *Corbicula* spp., *Corbicula*

sp., limo fragments, Ostrea, etc.

Sta 31, S. of road opposite sta. 30,
a zone of small borbiculas and either just
above it or ~~below~~ a stratum of several inches
in thickness composed almost wholly
of Ostrea, Anomia and a very few
borbiculas.

The fossils at many of the Crow Creek
stations occur in iron stone concretions,
in other cases in sandstone zones, more or
less concretionary, with shales above and
below, sometimes solid masses of fossils.

Very hot afternoon. Beautiful
sunset, the third very fine one for
the trip.

Bornish, Colo., Wednesday,

July 19, 1922

Bright, hot forenoon

Drove N. to Fosston, then east
across creek into a pasture S. of road,
then S.E. into first draw S. of road,
perhaps $\frac{3}{4}$ mi. or so from S.E. of
Fosston, being.

Sta. 32, sandstone (thin) filled with

large corbiculas, smaller corbiculas in an iron matrix in softer sandstone just beneath the larger ones, and all underlain by black shales. Shells mostly weathered, leaving internal casts lying on surface, the larger species mostly much distorted by pressure. Dips all about here apparently $N. 1/2 W.$ at low angle.

Sta. 33, Next draw S. in same pasture, same species, shells and fragments.

Sta. 34, next draw S. same pasture, probably same horizon. Corbicula in iron matrix, obtained mostly as casts.

Returned to pasture gate, then drove S. along pasture fence, at the edge of the "brecks" where the east slope of the valley meets the flat bottom land, to

Sta. 35, about half mile from the road, about 15 ft above bottomlands. A stratum of over a foot thick composed almost entirely of *Ostrea* and *Anomia*, badly weathered, exposed in the edge of a gully and about

3 ft. above it a Corbula horizon, with a few Corbicula, etc. Perhaps the same as at Sta. 26, but if so we did not find any Corbicula horizon above it.

Sta. 36, in the roadway east of Fosston, $\frac{3}{4}$ mile east of where we turned into the pasture for Sta. 32, Corbiculae, large and small, apparently same horizon as at Sta. 32.

Slight showers in afternoon, wind warm except while cloudy, sun hot whenever shining all day.

Saw many white-tailed jackrabbits and cottontails, prairie dogs numerous all about this district. Saw a black-tailed jackrabbit west of Briggsdale Monday and several S. E. of Corwith, but none since.

A man at Fosston told us that the brow creek waterholes are all dry this season, the driest since the country was settled, according to reports.

(Later we found waterholes full above Briggsdale).

Bornish, Bob, Thursday,

July 20, 1942.

Cloudy, very still morning, soon clearing to a very warm, sultry forenoon.

Drove N. E. through Briggsdale and on up creek along main highway.

A short distance S. W. of Briggsdale is a good exposure of 20 to 30 ft. of sandstones in E. bank of creek, mostly soft, white, with yellow ironstains, but including some hard, irregular strata ~~or~~ or lenses, all very strongly and irregularly crossbedded.

Reexamined the conglomerate S. of here at Sta. 27 and found no clay in it. Four miles N. of Briggsdale ^{E. side of creek}, same conglomerate ^{about 150 ft. above creek channel} occurs, also good exposures of Laramie strata, probably rather high in the formation, soft sandstones and clays, with a couple of thin seams of impure coal, but no fossils.

The creek here contains water, stagnant, with abundant Physa and Planorbis, but found no Sphaerium. Two orange-striped gartersnakes in creek.

Saw one hog-nosed snake at Bornish, the second for the trip, the first being

S. E. of Wellington. also one rather at borwich
second for the trip, the other being N. E. of
Wellington.

Drove on to point about 7 mi. ¹ due
N. of Biggsdale, beyond where main road
crosses Little Crow creek above a reser-
voir, then back to Biggsdale and thence
west, across creek W. of Biggsdale saw
a dead badger.

Sta. 37, next draw N. of Sta. 29.
(July 17), same *Ostrea* sp. as at
Sta. 28 + 29, but *borbicula* horizon
absent or not exposed.

Then we drove $3\frac{1}{2}$ mi. E. of
Biggsdale, then back 1 mi. and 4 mi.
N. to where road crosses Crow creek
but found no fossils.

Revisited Sta. 36 and collected more
borbiculas.

Boiler & breezy in late afternoon, very
hot in middle of day

Borwich, Colo., Friday

July 21, 1922

Bright morning, with cool north

breeze.

Drove E. 4.6 miles to

Sta. 38, in edges of draw S. of road, a stratum composed of *Ostrea* & *Anomia*, with corbicle fragments scattered over the entire slope but not found in place.

White-rumped shrikes common along wire fences everywhere. A pair at camp with young just out of nest.

Burrowing owls common. Saw young ones at edge of hole yesterday.

This is all a buffalo grass and small prickly pear country, with yucca ^{marks} as the only larger plants except along creeks.

Osgood 7 3/4 mi. E. of Borwick.

Sta. 39, just S. of road 1 1/2 mi. E. of Osgood, small exposures of Fox Hills ^{ss.} concretion in which we found 1 *Maclurea* & 1 *Halymerites*, and several fragments of *Lardium speciosum*.

^{S. of road} 1 mi. farther E. is a low hill, in the edges of which are thin bedded brown ^{rather} concretionary sandstones like those at Sta. 39, one *Halymerites* found but not saved. On top of the hill are fragments of the Pleistocene (?) conglomerate such

as we found along Crow Creek but not so coarse, and over the top and slope are found abundant iron fragments and much weathered *Ostrea* fragments, evidently weathered from the Laramie. Fragment of silicified wood look like Eocene wood.

1 mi. farther east, near top of a hill, an irregular, light-gray ss. contains *Halymerites*, a few small *Ostrea* fragments on surface of slope. None collected.

Sta. 40, 4.2 mi. E. of Osgood, about $\frac{1}{2}$ mi. N. of road, low bluffs of soft white Laramie ss., capped by about 2 ft. of hard, dark brown ss., above which is a zone containing corbicular, *Ostrea* and *Anomia* - only weathered exemplars obtained.

In place a stratum several inches thick is composed of corbicular extending down into the brown ss. The basal white ss. is composed mostly of very fine grains of ^{white} quartz with some black and brown grains. Slight dip N.E.

One rattlesnake here.

ss. of Sta. 40 extends along for a mile east. Saw 3 black-tailed and 2 white-tailed jackrabbits and one cottontail.

in crossing a small pasture,

Sta. 41, $7\frac{1}{2}$ mi. E. of Osgood, black shale in E. bank of draw, fragments of very large thick *Ostrea* in shale, small fragments of *Borbicula* scattered over surface of draw, probably from the Sta. 40 ss., which probably crosses it above.

An adult and young white-tailed and adult black-tailed jackrabbit all within 2 rods.

Next draw, half mile E., same shale bed, apparently overlaid by soft white sandstone.

Sta. 42, 1.4 mi. E. of Sta. 41, thick bed of *Ostrea* + *Anomia* in E. side of draw, no *Borbiculae*, *Oysters* mostly small, but a few large, thick fragments.

Sta. 43, ~~$8\frac{1}{4}$~~ ^{8.4} mi. E. + $4\frac{1}{10}$ mi. N. of Osgood, soft white ss. by road side, with thick layer of weathered *Borbicula*, *Ostrea* + *Anomia* just above it.

Rained & cooler toward evening, with N. wind.

Corinth, Colo., Saturday,

July 22, 1922

Bright cool morning, sun hot out of
breeze.

Drove E. of Osgood to sta. 43, which
we reexamined. The ^{probably thin bedded} harder layers in the
massive soft white ss. immediately below
the *Oyster-Aronia-Borbicula* horizon
contain *Halymeria*. The *Borbicula* were
found only at one point, badly weathered,
in a stratum several inches thick
composed almost entirely of *Borbicula*,
with the *Ostrea* resting directly upon
the sandstone, with the *Oysters* and
Aronia above.

At Sta. 44, $\frac{3}{4}$ mi. N. & $\frac{1}{2}$ mi. W. of
Sta. 43, *Borbicula*, *Ostrea* & *Aronia* about
a prairie dog hole, in pasture

about $\frac{1}{4}$ mi. N. & N.W. of Sta. 44 is
a hill 40 to 50 ft. above Sta. 44, capped
by a considerable thickness (perhaps 20
feet or so) of soft yellow ss. with some
harder layers, overlaid by a thick
bed of clay, in the upper part of

which a little coal has been brought up
by prairie dogs. Numerous ^{very} fragments
of *Borbicula* shells on the surface of the
slope close to the top may be wind-
blown, as none was found in place and
no large fragments (but see below)

2 rattlesnakes among the rocks.

Several cottontails & one white-tailed
jackrabbit.

This side of Osgood saw a bullsnake.

Sta. 45, at W. end of hill above
mentioned we found the *Borbicula* in
an excavation made in the coal horizon
just below the yellow ss. at top of clay.
Being in the clay it was almost im-
possible to get good specimens.

Sta. 46, 20 ft. below and 200 ft. W. of
Sta. 45, in E. edge of deep draw, a
stratum about 1 ft. thick near top of
bluff filled with *Borbicula*, many of which
were obtained in fine condition.

~~20~~ 3 ft. below the *Borbicula* horizon
was *Anomia* in the shales.

Drove $\frac{1}{4}$ mile ^{west} to next N.-S. road and
walked west across pastures
^{a little S. of W. from} Sta. 46
Sta. 46 $\frac{1}{2}$ to first draw, a few hundred

yards W. of road, same sandstone as at Sta. 43, with numerous fragments of Halymenites preserved in it in the soft white sandstone.

Sta. 47 bottom of next draw a few hundred yards west of Sta. 46, a thick horizon composed of Ostrea, Corbicula and very large fine Anomia. It looks as though this dips beneath the Halymenites ss. off Sta. 46.

Sta. 48, next draw ^{about 1/2} W. of Sta. 47, stratum several feet thick composed largely of Corbicula sp., Ostrea & Anomia. This is underlain by very soft sandstone and overlaid by about 3 ft. of black shales, above which 25-35 ft. of soft white ss. forms a rude bluff capped by overhanging ledges of a hard, brown ss. a foot or 2 thick, somewhat ripple marked and strongly crossbedded. From here the slope for half a mile westward nearly to the top of a hill is shale, with some coal and one or more fossil horizons in which we recognized, but did not collect Ostrea Anomia and Corbicula. The hill is capped by a brown ss. same as at Sta. 45, at the edge of the hill is

a bluff 20 ft. high caused by quarrying
coal.

Returning to Sta. 46², down creek a few hundred yards we found the thick fossil bed sta. 47 & 48 occupying the bed and extending 2 ft up the E. bank of the channel, above this 2 ft. greenish yellow soft ss, overlaid by 8 ft. of black and yellow sandy shale, above this is the clear yellow soft ss. overlaid by the ~~mass top of~~ ^{thin} which we found the *Holymenites*, undoubtedly the same sandstone that overlies the *Corbicula*, *Ostrea*, - *Anomia* *virgata* at Sta. 48.

Ring-necked pheasants with young
at @ spoad

The hill where coal was mined, mentioned at top of page is about a mi. or less N. and 300 yards E of the N. W. corner of Morgan County, Sta. 48 is a quarter mile or so E. of a line drawn N. from same corner

Bright, with fairly cool breeze all day.
Walter Spall and William Kine,
cousins, boys of borish, interested in fossils.

Mocking bird singing at camp this morning and heard one yesterday at stat. 45.

Bullock's orioles at camp.

Saw Brewer's blackbird at ^{N. 53.} Suggsdale the other day. English sparrows abundant at Cornish. On dry divide shore larks abundant.

Quite cool evening.

Cornish, Cal., Sunday.

July 23, 1922

Fair day, cool evening.
In camp all day.

Cornish, Cal., Monday,

July 24, 1922.

Cool, rained at Cornish, not extending far east, in morning as we started.

Rocky Point, 4.2 mi. S. E. of Cornish, remnant of conglomerate 12 to 15 ft. thick crowning a high hill, weathered into large blocks, some of which have been let down the slopes by undermining. Composed of mountain debris up to 5 or 6 inches in diameter, with a

few small fragments of wood, hard, thoroughly consolidated, much resembling the portions of the mountain conglomerate, much cross-bedded.

Sta. 49, 8.2 miles E. of N.W. cor. of Morgan Co. and $4\frac{1}{10}$ mi. N., on E. side of road, doubtless Wildcat creek, thin ss. hard, containing Halymenites and many iron concretions $\frac{1}{2}$ to $\frac{3}{4}$ inch in diameter. One hard pinkish layer occurs bearing fossil wood. This exposure, with another S.E., shows that the harder ss. is underlain by a very soft, white to yellow ss. several feet in diameter, ^{thick} below which clay shales, including some thin ss. beds, extend down ~~to~~ ^{slope} Sta 50 or 60 ft., and perhaps clear to bed of dry channel of creek, a few oyster fragments ~~are~~ ^{on} top of upper ss. near top of slope.

$6\frac{1}{10}$ mi. N. & 1.4 mi. E. of Sta. 49 is a lot of very coarse, almost conglomeratic, sandstone in several exposures, composed of mountain debris, very much crossbedded, at least 20 ft. thick.

above it to the N. is a white exposure, possibly Brule clay, not examined. We followed up drainage to the north from where the road crosses the conglomerated sandstone and there found as follows. In the bank of the channel is an exposure of the soft, yellow white Laramie ss. capped by hard ss. with a pinkish layer, containing poorly preserved Holo-mites, as at Sta. 49 - collected none. Above this is the Brule clay, at least 60 or 70 ft., or what closely resembles it, not stratified distinctly, noticeably, dark gray to drab, weathering to pinkish and white, capped by the coarse ss. possibly the Arkhasee, somewhat conglomerated with pebbles up to half inch in diameter, in places.

rove ^{over Brule clay} about a mile farther north to top of a hill from which we could see Pawnee Buttes, nearly north of us.

Then drove back to an E-W. road 2 miles N. of the Morgan Co. line and 4.3 mi. W. of ~~Sta. the~~ and turned W.

Sta. 50, 4.3 mi. W. of the road just W. of the Brule clay, in a ^{rather} flat district with no rock exposures in

sight, found numerous Ostrea and a few
around about prairie-dog holes.

Sta 51, $\frac{1}{2}$ ^{or $\frac{3}{4}$} mi. N.W. of sta. 48, at
head of draw, just W. of road which
runs N. from N.W. cor. Morgan Co., just
above a coal outcrop, Modiola + Corbicula
in poor state of preservation, coal 18 inches

Sta. 52, 1 mi. ^{W.} E. and ^{mi.}
of Sta. 51, just above a thin coal seam, a
3-inch band containing Corbicula, the
shells weathered away, leaving good casts

1 Black-tailed jackrabbit here, White-tails
& cottontails abundant everywhere - many young
cottontails.

Fairly cool breeze most of the day,
with several slight showers.

Bornish, Colo., Tuesday,

July 25, 1922

cool, cloudy morning, some clearing.

Drove to coal creek (not shown on map)

N.W. of Bornish, 2.1 ^{thence} mi. W. + 2.3 mi. N.W.
in E. bank of creek about 8 or 10 ft. soft
white ss., underlain by same amount of

clay, with thin coal seam intervening. Green nodules and iron streaks in it; also many fossil leaves at one point but could not get identifiable specimens because rock was concretionary and broke in every direction except along original bedding planes.

Physa in waterholes, not collected. At head of creek about $3\frac{1}{2}$ mi. N.W. of last locality, great beds of clay, with coal and thin sandstones, like upper exposures at sta. 46, sandstone at top containing plant stems & one fragment of broad, net-veined leaf.

Here we found a salamander (small) on dry buffalo grass 100 ft. from creek bed, no permanent waterhole here.

In waterholes a mile or two below here, were large numbers of very small, starting fishes, and two or three small turtles - perhaps painted terrapins.

First draw $\frac{1}{4}$ or $\frac{1}{2}$ mi. ~~N.W.~~ W. of Orford P.O., numerous fragments of Ostrea and Corbicula, none collected - very hot part of day. Shipped 4 boxes of fossils.

Bornish, Bob, Wednesday,
July 26, 1922

Bright hot morning.

Drove through Briggdale and Keoto
to Pawnee Buttes.

Just S. (2-3 mi.) of Keoto and all around
Keoto are Beule shales, with ~~arkose~~
ss. remnants at many places. These
remnants have the appearance of having
been let down from higher levels, as they
are shattered into numerous irregular
blocks standing at various angles, as at
the station mentioned in notes of July 24.
The conglomerate itself and that of July
24 is different from that of the top of
Arkose at Pawnee Buttes, etc., in that
it is composed entirely of quartz and
other mountain debris while the Arkose
at Pawnee Buttes contains great numbers
of pebbles of what look like hardened
clay, up to two or three inches in
diameter.

Revised

Pawnee Buttes, July 27, 1922
Cloudy, cool day.
Reached Boulder at 5:30 p.m.

Boulder, Col., Friday,
Aug. 18, 1922

Drove to Bob's Spring alone and
went to home of Prof. J. A. Koyte.

Colorado Springs, Saturday,
Aug. 19, 1922

Started on road to Canyon City
4 mi. (or so) N. of Pawnee fine exposures
of Greenhorn ^{limestone} sandstones with Timpas
at top of mesa. Upper l.s. band
of Greenhorn and a ss. layer just
above it filled with *Succranium*
labiatum. A number of harder bands
in the limestone stand out or make
small benches in the slopes.

Camped at Bob's Spring on
N. side of Kansas River about 12(?) mi

above Pueblo, ~~on N. side of~~

The spring is strongly mineral - calcium carbonate and sulphur, the gas escaping with strong appearance of boiling on top of a low mesa. The spring has built up a formation around it and cemented river gravel into a conglomerate exposed in a railroad cut. Water cold.

The upper Benton well exposed in bluffs on both sides of river. At base of bluff is a great thickness of thin-bedded Carlile shales - black - above this is the Pugnellus, about 15 to 35 ft. or more capped by a 2 ft. bed of brown shark-tooth sandstone. The top of the bluff is Timpas flower. Niobrara L.

A conglomerate is found in many places, evidently either Tertiary or early Pleistocene, from 100 to 200 ft. above the river bed. I believe, ^{in some places occupies} old valleys.

Very hot & dry here

Carlile Spring, Colo., Sunday,
Aug 20, 1922

Another very hot day.

This is the type locality of the Carlile

shale. ^{characteristic}

We have collected a *Pugnallus* fauna in the *Pugnallus* sandstone for a mile or so along the bluff, but *Pugnallus fusiformis* is not abundant.

Pueblo, Col., Monday,
Aug. 21, 1922

Another hot day for noon

Drove to Pueblo, then 5 miles up river to cement plant, type locality of *Inoceramus deformis placidus*, which appears to be *I. deformis*, abnormal examples.

Then visited Baculites Hill N.E. of Pueblo. It is just above the upper Bechet butte horizon. It is overlaid ~~by~~ at top of butte by *Plectambonites*? ^{Musselman} conglomerate, near type locality, *I. helical*.

Colorado Springs, Tuesday
Aug. 22, 1922

Bright morning.

Drove up Williams canyon and collected *B. inflexa*, *Corthis desmopleura*

trilobites & gastropods near base of
Lower Ordovician, ^{about six} feet above the
top of the Cambrian. Also some
fossiliferous pieces from the upper part
of the Cambrian.

Colorado Springs, Wednesday,
Aug. 23, 1922.

Another bright morning.

Collected *Terebratulas*, *Wastros*, *Baculites*,
Nucula, *Pteria fibrosa*, etc., from
Lower Fox Hills Cretaceous, N. of town,
about 1 mile S. of Woodman's Home. The
upper Cretaceous here is a massive
sandstone as at Boulder, etc. The lower
part is thinner bedded sandstone layers
with some shale. The underlying Pierre is
clear, darker-colored shale. The fossils
in the Lower Fox Hills occur chiefly in
concretions from 5 to 10 inches in diameter.

Colorado Springs, Thursday,
Aug. 24, 1922.

Another very hot day.

We worked a little in the Permian (beneath the Fountain) and the Lower Ordovician N.W. of Colorado Springs about 2 miles S.W. of Woodman P.O. (Woodman Home).

Then I took pictures of monuments in Monument Park, E. of Woodman, about $\frac{1}{2}$ mile N. of Colorado Springs.

Spent afternoon in paleontological collections at Colorado College.

Colorado Springs, Friday

Aug. 25, 1922

Cool breeze most of day.

Collected a few Ordovician fossils in cliff ^{just} N. of Henry's castle and took pictures.

Colorado Springs, Colo.

Aug. 26, 1922

Reached Boulder in afternoon

Boulder, Colo., ~~Sept. 31,~~ ^{Sept. 31,} 1922
Drove to Silver Lake with Ed. Taagen,
(photographer) and Ralph Squires. Fine day.

Silver Lake, Sept 2, 1922
Went up past Disappearing Falls to
North Arapahoe Glacier. Both this and
Arapahoe Glacier quite bare of snow.

Boulder, Colo., ~~Sept~~ Thursday
Sept. 7, 1922

Left Boulder at 9 a.m. with wife
in flivver. Left her at Denver and
continued through battle Rock and Eliza-
beth to Elbert thence $2\frac{1}{2}$ or 3 mi. S.
to Ralph Hubbard's ranch, where I
put up my tent at 4 p.m.

Very warm day.

Ranch house surrounded by
rock pines.

Elbert, Colo., Friday,
Sept. 8, 1922.

Ralph Hubbard and Julia Saloman
arrived at 1 a.m. by wagon.
Booker today.

The Hubbard ranch is all or nearly
all on Dawson arkose. Open park-like spaces
and rock pine groves characterize the
rounded hills and shallow valleys.

About $\frac{1}{2}$ mi. N.W. of the new house and
windmill is a bluff capped by baffle
Rock conglomerate.

The Dawson arkose here is very light
gray to white, not very coarse, rather
friable where exposed to the weather.

The baffle rock conglomerate is much
darker, harder, with siliceous cement, and
contains some larger pieces, including
shyolite. It is a bluff maker.

The Dawson at our rather high
horizon yields numerous fragments of
"wood jasper," varying from white through
various shades of yellow and red.
It appears to be silicified palm wood.

Edgart, bob, Saturday,
Sept. 9, 1922

cool, breezy morning.

Hubbard and Tolson left on the
7 a.m. train.

I drove N. 10 miles from Edgart ^{or 11}
to Kiowa, then E. across one creek
into Bijou valley, about 6 miles,
taking the more southerly ^(S. of E.) road where
the road divides at ~~a~~ east edge of
the town.

about half way down into the
valley, $\frac{1}{4}$ mi. S. of road, a hill com-
posed of clay is covered by angular
blocks of coarse sandstone ^{2 ft or more thick} consisting of
a fine, light-gray ground mass, through
which are scattered numerous small
white quartz pebbles, mostly under $\frac{1}{4}$ inch
in diameter, but a few up to $\frac{1}{2}$ inches.
The ground mass looks much like the
Dawson, but fossil wood fragments are
very different. It contains great numbers
of iron nodules up to 2 inches or more

in diameter, such as characterize
the Laramie N. E. of Greeley. In places
the weathered-out nodules fairly
cover the ground.

This is an open, somewhat rolling
valley, fringed with ~~the~~ trees, probably
mostly on shallow soil covering rocks.

About $\frac{1}{4}$ mi. farther east a gully
by the roadside exposes a thin sandstone
containing much mica and many black
grains, and a few concretions, beneath
which is a very carbonaceous clay bed
or very impure lignite. Some fossil
wood fragments appear same as those
found in or near the conglomerate.

Crossed creek and turned south.
Here the ^{East} valley slope exposes clay shales
and iron concretions and irregular sand-
stones. The concretions and sandstones
contain leaves, but break so irregularly
that it is almost impossible to obtain
any specifically identifiable specimens.
The sandstones ^{are} very micaceous.

Saw one small block of conglomerate
about 1 mile farther south is a
bluff, facing east, with bad-land

topography down the gullies ^{weathering} yellow
Below is a thick bed of clay,
overlaid by conglomerate similar to
that west of the creek. Above this is
a bed of black shale perhaps 10 or 15
ft. thick, including one or more thin
bands of lignite, and ~~one~~ ^{two or more} bands
of selinite.

The top of the bluff is a very soft
more or less pebbly, white ^{or fine conglomerate} sandstone. The
sand from the weathering of it runs down
over the steep slope and washing the forma-
tion and making it impossible to deter-
mine, without a great deal of digging,
how much of the slope is shale and
how much, if any, is sandstone
except the upper 5- or 10 ft. My
impression is that it is mostly clay.

I should not be at all surprised
to learn that the friable ^{upper white} sandstone
is Dawson arkose, as ~~at~~ the weathered
sand from it is the same as occurs
in the gulches cut from the Dawson
at Elbert. It caps the hills along the
road on the west side of Bijou valley also.

I believe the thick clay formation constituting most of the slope is Laramie. Then drove North a mile, beyond where the road crosses the creek, and then east to the hills low, rounded hills that border the valley. Here is a great ^{zone} ~~bed~~ ^{layer} of iron stone concretions in clay. Found no fossils. ~~It is probably Laramie.~~ No indication of Post Laramie material hereabouts.

Raw wind all day. Bright sun

Elbert, Colo., Sunday,
Sept. 10, 1922.

Bright day with a raw wind.
Stayed at ranch all day.

Elbert, Colo., Monday

Bright, warm day.

Sept. 11, 1922

Drove to Elbert, thence due E. to 7 miles to the W. side of the valley of West Bijou creek & as it is named on the map. A rancher says it is the "main" Bijou. He had never heard of West, Middle and East Bijou.

The Laramie is here well exposed, of about the same character as where I examined it Saturday. It consists chiefly of clay, partly shaley and partly massive, with thin sandstones ^{strongly} impregnated with iron (weathering into concretions) and at least two seams of very impure lignite about 2 feet thick. An upper clay is very fine grained and pearl gray, breaking with peculiar conchoidal fracture, smooth, like slickenside, along the fracture surfaces ~~that~~

The coal does not appear to have been mined in this country, as it has farther north - at least I have found no openings along the veins. Perhaps this is due to the abundance of wood here and the impurity of the coal.

About the middle of the exposure the clays, sandstones and ironstones are filled with fossil leaves, but as the rocks do not break well along

bedding planes it is difficult to get good specimens. By much digging and breaking of rock in ^{the side of} one gully I got a few examples which may prove identifiable.

Clay in places about this valley appear to have been baked, perhaps by the burning of lignite seams.

At the edge of the valley, a mile west of the fossil leaves, there ~~is~~ seems to be much weathered Dawson Arkose on the high ground, supporting a growth of rock pines.

Albert, Colo., Tuesday
Sept. 12, 1922

Bright, breezy morning, warm in the sun.

Drove to yesterday's fossil leaf locality then a mile or so east across the creek and climbed the hills to the S.E. Nearly half way up slope I found leaves in iron stone but got no good specimens. Perhaps 40 or 50 ft. above this are clays and shales.

with some sandstone bands thoroughly impregnated with iron, one clay bed showing action of heat. One thick bed of clay weathers into peculiar, smooth sided mounds 10 to 15 ft high and twice as wide.

at the tops of the hills is a very friable ^{coarse} ~~fine~~ ^{pure} ~~white~~ ^{yellow} sandstone about 10 ft. thick, capped by two or three feet of very coarse, brown to red resistant sandstone. The same thing may be seen in a bluff about a mile N. of the fossil leaf locality.

A recent gully on the west face of these hills has cut into 2 coal seams from 6 to 8 ft. thick, separated by a few feet of clay, from 75 to 100 ft. below the top of the Laramie. Many thin bands of soft sandstone or sandy shale, from 1/2 to 1 inch thick, scattered through the lignite makes it very impure, but in the absence of more acceptable fuel it would do fairly well for heating and cooking stoves.

bathrooms & willows line the creeks.

Elbert, Colo. Wednesday.

Sept. 13, 1922

Drove to east side of Bijou creek, east of Kiowa, where I was yesterday, and took pictures of the peculiar mounds in the Laramie clays, a bright, warm day.

Elbert, Colo. Thursday

Sept. 14, 1922.

Bright, hot morning.

Drove to Bijou Basin. The basin is cut into the Dawson arkose, but possibly not down into the Laramie. Very little rock exposed except along the marginal slopes. Some baste Rock conglomerate on top of the bluff on the north side and probably at other high points. Large boulders of quartz, etc., up to 6 or 8 inches in diameter scattered over the higher ground profusely, doubtless weathered from the baste Rock conglomerate.

blondy afternoon.

Packed most of the outfit in the car, preparatory to starting home in the morning. Have been alone on the ranch since Saturday morning, sleeping in my tent, but cooking in the kitchen.

No oaks seen about here, but many on the bluff north of Bijou Basin.

Elbert, Colo., Friday,

Sept. 16, 1922

Left Elbert 8:30 a.m., travelled by way of Parker and Cherry Valley 99 miles, reached Boulder at 1 p.m. blondy before noon.

Boulder, Colo., Wednesday,

Sept. 20, 1922.

Bright morning.

Left Boulder alone in flier at 8:30 ^{a.m.} speedometer at 2002

Arrived at battle Rock 11:30 a.m.

Cobrado Springs, 2:15 p.m., speedometer
at 2109.

Pueblo 4:25 p.m., speedometer 2153

Then East to Boone along N. side of
river, 20 miles, crossed river & drove
on 16 mi. to Fowler, stopping at new
Hotel Fowler at 6:30 p.m. Speedometer
2190.

Roads quite rough and sandy
much of the way. Skidded badly
several times, struck another car
once, cutting a tire (both skidded).

Fowler, Colo., Thursday
Sept. 21, 1922.

Bright, cool morning

Left Fowler at 7:30. Reached
Caddo, about 70 miles, at 11 a.m.,
and Floyd Sniff's ranch, about 8
miles southeast, on Muddy Creek,
at 11:45.

Two tusks of mammoth occur in the
base of the steep bank of the creek about
1 1/2 or 2 mi. N. E. of the Sniff Ranch house

Sakota sandstone (probably upper) rims the broad flat valley. The valley was eroded at least 12 ft. below ^{the} ~~the~~ present level of the top of the creek banks in Pleistocene time and afterwards refilled to at least that depth. The base of the refill, at least, is probably Pleistocene, and perhaps all of it. The basal two or three feet are ~~comp~~ unconsolidated conglomerate, composed of angular pieces of Sakota sandstone up to 6 inches in diameter (mostly under 3 inches) coarse sand and gravel. This is overlaid by a thick deposit of finer (though not very fine) sand, showing rather obscure bedding.

The tusks are ~~best~~ buried mostly in the conglomeratic layer, though extending ~~partly~~ slightly above. They are both very much weathered - probably too much to be saved. The basal ends of both extended from the bank and much had doubtless weathered off. Some neighbor had recently dug out and broken off ~~three feet~~ a foot of one of them. The remainder is about 4 ft. long, 7 inches or more

in diameter at the large end which rests in a nearly horizontal position, the smaller end extending into the cliff with a strong downward curve to a vertical position its ⁵⁻⁶ inch broken off end resting on a large piece of sandstone well down in the conglomerate.

The other tusk rests with the large end horizontal, the broken small end curving upward into a vertical position.

If the skull and other bones were ever here, they were where the arroyo is now and have been swashed away in the erosion of the present channel. However, the condition and position of the tusks, their broken off ends, etc., indicates that they were transported to their present location after severance from the carcass, though, in that case, it is a strange coincidence that they should be together.

at the top of the bluff - bank of the creek shells of *Sphaerium*, *Physa*, *Planorbis* and *Succinea* are common. Many examples are found on the face of the bluff lower down, but very im-

opinion is that they were washed down
by storm waters from the top and
cemented to the face of the bluffs
by a film of mud. ^(afternoon found this part sands) Now were
found in the digging around the
tusks. Two badly weathered shells of
Naiades were found in the sand ~~at~~
deposit ~~to~~ a foot or two above the
conglomerate.

Sniff's Ranch, Laddoa, Colo.

Friday, Sept. 22, 1922

Bright, cool morning.

Drove to town and ordered two gallons
of shellac from Los Animas, to use in the
hopeless task of trying to save the tusks.
Then back to the creek and excavated
about the tusks as far as I dared.

Found a box tortoise at the creek.

Dug out a pretty good fair skull of
the big extinct bison about 5 or 6
feet above the creek bed 1 mile up creek
above the mammoth remains and
parts of another about 250 ft. down

creek below mammoth remains.

Siiff's Ranch, Saturday,
Sept. 23, 1922.

Bright, cool morning, warm later.

Finished excavating mammoth tusks, and hardware man and for or five others came out to take them to town, as they are in too crumbling a condition for successful treatment and transportation to Boulder. We turned them out on plaques covered with excelsior and bound them with burlap and excelsior. Both broke into several pieces and crumbled considerably.

Saw one roadrunner, and a flock of "blue" topnot quail, as they are locally called. White-tailed deer said to be common in the Arkansas Valley near ~~here~~^{here}. One pair of antlers at the ranch.

Siiff's Ranch, Sunday,
Sept. 24, 1922

Yesterday we found the mollusk shells scattered through the Pleistocene sands, almost to the basal gravel.

Found skulls and other remains of two or three more fossil bison. With one we found the lower jaw and several vertebrae and ribs in good condition, and one small pearly fresh water mussel with both valves together. Orval Swift made this find. His brother ^(Orval Swift) Elroy led me to the best skull. These were ^{both} due east of the Swift Ranch.

Today I went with the Swift family and relatives to a spring about 15 miles S. of the ranch, called Hand Spring, because there were formerly several large hands painted on the overhanging Dakota sandstone. It is a fine spring.

Saw two black-tailed jackrabbits. Swift reports many "snowshoe" rabbits north of the river, but his description proves them to be white-tailed jack rabbits.

Sniff's Ranch, Monday,
Sept. 25, 1922

Have had typical bright, warm
September days and cool nights.

Started home at 8 a.m.

Dined at Fowler at noon.

Reached at 2:30, Colorado Springs at
4:45, Palmer Lake at 6:15, where
I stopped for the night at a good
little hotel.

In Saturday's notes I neglected to
say that at the last fossil locality the
original sandstone bluffs bordering the
valley before the fossiliferous Pleistocene
sands were deposited are exposed by the
meandering of the stream in its down-
ward cutting, the east bank at one bend,
the west bank at another. The Pleisto-
cene sands are in contact with the
edge of the Dakota sandstone strata,
and show plainly a filling of at least
from 25 to 50 feet.

Boulder, Colo., Tuesday,

June 12, 1923.

Bright morning, threatening afternoon.
Left Boulder with John Byrnes, ^{new} flier
and camp outfit. Car has old speedometer
from former car set at 2620 when new
car was purchased in March - 2750
this morning on leaving Boulder.
Passed through Colorado Springs and
Manitou and camped at Florissant.

Gasoline 10 gal. at Boulder

4 " " Castle Rock

2 " " Manitou

1 " " Florissant.

Florissant, Wednesday, June 13, 1923

Bright morning. Visited "new" Petrified
Forest, 1 mi. S. of town, Eva D. Henderson,
Proprietor.

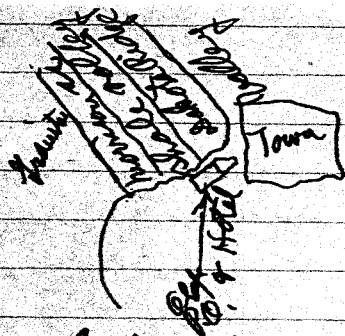
Started W., with speedometer 2902.

Took panoramic ^{photo} of South Park from
hill where we first saw it.

Moll. Sta. 412, shallow lake in ~~the~~ South
Park, speedometer 2925, about 8 mi. N. of S.

from Hartzell, near Ocean to Ocean Highway.
Stopped at Hartzell at noon for new
brake linings, Speedometer 2933.

Just W. of Hartzell sedimentaries reser-
bling Morrison and Dakota rest upon
granite. At base is a 50 or 60 ft. ss.
very slightly conglomeratic, dipping steeply
N.E. Above this (geologically), occupying
a valley ^{100 to} 200 ft. wide, is a clay shale,
exposed in railroad cut. On the N.E.
slope of the valley reddish ss. and shale
occur, overlaid by what appears to be
typical Dakota, capping a ridge with
dips N.E. at foot of ~~the~~ slope are
shales which may be Benton or Hishon.
Reddish exposures resembling Morrison
are seen a mile or so S.E. The state
maps show ~~the~~ Hartzell as W. of the
Dakota-Morrison outcrop, but it is
east; however the old Hartzell P.O. years
ago, which probably furnished the data
for the map, was at the W. end of what
is now the South Park Fish & Game Club,
at the end of the outcrop, thus



The town plat shows the hotel about 1000 ft. W. of E. line of sec. 8, T. 12. S., R. 75 W., and perhaps same distance or farther from S. line, N. of line of old Midland R.R.

Left Hartzell at 5:20 p.m. and camped ^{8 or} 10 mi. up Trout creek
 4 gal. gas. at Buena Vista
 2 mi. Leadville

Eagle River, below Minturn,
 Thursday, June 14, 1923

Started on at 8:15 a.m.

Leadville at noon

Camped between Minturn and Woolath at 6 p.m. Warm day.

2 gal. gas. at Leadville

Pennsylvanian rocks on both

sides of river at camp. Half way to top of canyon wall on S. side the thick stratum resembling La Plata ss., pink, massive ss. as at Owl Canyon, dips down stream at a low angle, but across the river the shales, l.s. and deep red, thinbedded ss. are almost vertical. Section should be examined for fossils. The camp is at mouth of Agua Creek, which appears to occupy an eroded sharp anticline.

The "La Plata" massive ss. is overlaid by Morrison with Dakota capping the canyon wall below camp, underlain by deep red "Logans", which in turn is underlain by Pennsylvanian, all dipping downstream (west), steeply below just below camp on N. side of river, more gently farther down, practically vertical directly opposite camp and steeply east above camp. Formations not examined, but notes written in camp from what can be seen.

Squaw Creek, Colo., Friday,
June 15, 1923.

Bright morning.

Started down river at 8:30 a.m. -
about 2 mi. down river (above
Walcott), the Massos appears.

The gypsum farther down seems
to be in the Pennsylvanian.

The basalt below Gypsum appears
to be a flow after the erosion of the
valley to approximately its present
level. If an ancient laccolith exposed
by erosion there would be river
gravel in the cavities, which we
could not find. It is very light,
vesicular and though much weathered
showsropy structure in many places.
The valley here is a sharp eroded anticline
the dips being away from the river on
both sides which may mean a line of
weakness through which the lava broke.
It is full of pits, some 10 or 15 ft
deep. ^{most of} this is the base of a deep-seated
laccolith.

Five miles below Glenwood the

lower part of the red beds is a conglomerate, resembling Fountain, with pebbles up to 1 inch diameter. This is overlaid by several hundred feet of red ss. then bluish gray ls. ? and shale ?, then Morrison ?, with Dakota capping the ridge S. of river, all dipping steeply South.

about 2 or 3 mi. down river the Kansan and Neosho appear on S. side

Reached Byram Ranch, near mesa, at 5:30 p.m.

5 gal. gas. at Gypsum.

Mesa, Colo., Saturday,
June 16, 1923.

Hot, bright breeze.

Rode horseback to foot of Horse-Thief Mt., N. E. of mesa, then climbed over Wasatch ls. & shale and lower Green River shale more than half way up slope of the mountain.

Foss. Sta. No. 1, in Green River shale very close to base - large *Physa*, probably *P. jekronatis*, and large *Planorbis*,

rather abundant, in a thin stratum
Foss. Sta. 2, about 75 ft. above
Sta. 1.

Foss. Sta. 3, below Sta. 1, probably in
upper Wasatch.

Fragments of mammal bones near the
Sta. 1 and 2 horizons.

Moll. Sta. 413, below Foss. Sta. 3;
Orchelimum sp. Found none alive.

Grand Junction, Monday.

June 18, 1923.

Came down from Mesa this
morning. Called on Ross of the Business
College and others. Got room at the
Y. M. C. A., as there is no good camp
ground.

Grand Junction, Tuesday.

June 19, 1923

Dined with Logans Club at noon.
Left at 4 p. m., with accompanied by O. D.
Williams; arrived at Gateway at 8:30 p. m.

Speedometer indicating 58 miles.

Gateway, Colo., Wednesday,
June 20, 1923.

Drove 10 mi. up Solares River in Ford truck with E. J. Mullineaux, accompanied by George Foy and Irving Ames, also Williams and Byrnes. Then climbed for four miles out of the canyon to examine dinosaur bones in the McCulloch formation.

Found fragments of bones in a sandstone well down in the formation. Higher there were many bone fragments lying on "blue" clay, as the men called it, ^{mostly} all much weathered. They had evidently weathered from an overlying sandstone (in which we found part of one bone in place) and had been let down the slope by undermining.

Back to Mullineaux ranch at 3 p.m.
cloudy day.

Mullineux Sta. 414, Oreobolus, on trail out of canyon to dinosaur bed, about 10 mi. out from Gateway.

Gasoline 3 gal. at Gateway

For geology see tomorrow's record

Grand Junction, Thursday,
June 21, 1923

Drove to The formations ^{along highway} here from
the river bed up are.

(perhaps Maroon Canyon)
conglomerate and micaceous ss.,
resembling the Fountain, resting on
granite. Above this is Dolores ss.,
including the ^{red} massive cliff-making
bed, above this is a series of lighter
colored, less massive, thinner bedded
sandstones beneath the massive
pink-white La Plata ss. that
weathers in rounded outlines, like
the ^{upper} layers of Larimer Co. The
McElmo ~~is~~ returned Elmo lies above.
This. We went no higher. The
McElmo is about as far south -
several ss. benches below and
much more shaley above.

Returned to Grand Junction in forenoon.
In afternoon we drove to Colorado
National Monument 9 W. of Grand
Junction, locally called Monument Park.
Took pictures of the natural monuments.

Granite at base of section
dolores resting on the granite - a
lime conglomerate near base not at
all like the "Fountain" conglomerate
1. of Gateway, perhaps the "Saurian"
conglomerate. The lower deep red,
friable beds are about 60 ft. thick,
the lighter red, massive, jointed,
cliffmaking member perhaps 250
ft. thick. This forms the monument.
Above this the La Plata & McElroy
looks about same as above Gateway.

Made a dry camp at mouth of
the monument canyon.

4 gal. gasoline at Grand Junction.

Colorado National Monument,

Friday, June 22, 1922.

Walked up canyon to take another
picture of the finest monument.

Sand storm all of morning.

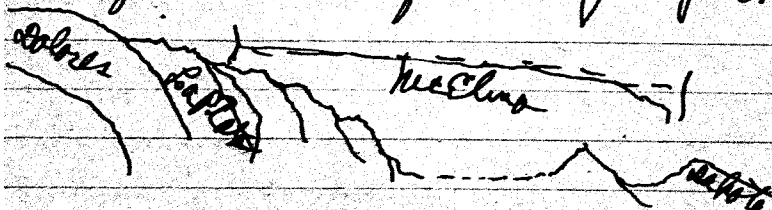
Mouth of canyon formed by cliff-
making dolores ss, which bends
sharply downward. Just outside
canyon, on W. side La Plata and

Mc Elms well exposed.

Lower part of La Plata ^{is} massive,
light ^{pink} ~~pink~~, contrasting with the red dolores,
weathering in rounded outlines, upper
half yellowish white, less massive,
not weathering to round outlines.

Base of Mc Elms reddish shales,
passing above into greenish l.s. and
shales, capped by and ~~ss.~~ 3 or four
sandstones inclined to make ridges,
total about 200 ft.; then red and green
shales, l.s. and much less ss., about
400 ft., making about 600 feet for
the Mc Elms - a hasty estimate.

Base of Dakota a beautiful white quartzite.



The Dakota quartzite weathers to black on the
surface and green beneath the surface.

Drove through Fruita and took
road running northerly to Rangely.
about ~~9~~ ⁵ to 6 mi. from Fruita the

road crosses a ridge of Lower mancos
paper shales,

5 mi. N.W. of Fruta
Foss. Sta. 4 *Ostrea congesta* or
Inoceramus fragments in paper shales.

Foss. Sta. 5, about $\frac{1}{2}$ mi. N.W. of
Fruta. Top of Mancos Cret. *Helymenites*
abundant, ^{one saved} One fragment of a big *opista*,
not saved.

Sta. 6, Lower part of Mesa Verde Cret.,
baked clay filled with plant fragments.
One piece containing *Levitzia reichbachi*
saved

Lime concretions 300 ft. or more
below top of Mancos contained a few
Baculites sp. and *Inoceramus* cf. *barabini*
but too badly shattered to obtain specimens.

Sta. 7 Above Sta. 6, *Helymenites* in
coarse ss., poorly preserved. Saved one.

Holbrook Sta. 115, ~~mi. W. of~~
Grand

Fruta, Colo., Saturday,

June 23, 1923

camped last night near Sta
7; broke camp this morning and

headed for Grand June.

Moll. Sta. 415, roadside ditch
6 mi. W. of Grand Junction.

Ligynea, *Succinea*, *Klamorbis*.

5 gal. gas. at Grand June.

Whitewater ^{Sta. 8}, lower Navajo bet. ore
hill ~~near~~ road from Grand June. to

Whitewater, 8 miles S.E. of Grand
June. *Scaphites warreni*, *Inoceramus*
fragilis, etc.

Reached B.V. Byram's ranch near
Mesa in evening.

Mesa, Colo., Sunday, June 24/1913

Bright & windy & hot

Moll. Sta. 416, along creek ^{+ spring brook} at Byram
Ranch. *Physa*, and *Ligynea* and *Succinea*
abundant, *Physa* & *Ligynea* small - *Succinea*
on muddy bank.

Mesa, Colo., Monday, June 25, 1913

Bright & hot.

Collected *Pisidium* at Moll. Sta. 416 abundant,
some very large.

Byram Ranch, Mesa, Colo.

Tuesday, June 26, 1923

cloudy morning, showery on Grand Mesa.
I rode north to N. side of — creek.

a heavy ss. here at base of bluffs I
take for top of Mesaverde. Above it is a
coarse ss. perhaps 50 ft. thick, brown on
surface, with coarse, very irregular con-
glomerate lenses interbedded, probably
the Ohio Creek conglomerate, overlain by
the highly colored, variegated ss. + shales of
the Ruby (Wasatch) Eocene, weathering
into bad-land topography.

The heavy upper Mesaverde ss. is
underlain by clay shales with carbon-
aceous beds.

In the Ruby the predominant color of the
sandstone members, especially in the lower
part, is very light gray, nearly white,
while the prevailing predominant color of
the shales is dull reddish, with considerable
light greenish gray. Sandstone blocks pro-
tecting underlying shales produce small
pinnacles, consisting of shale and clay and

ss. fragments which have "run" down the steep slopes during storms and re-consolidated under the heat of the sun. Some of this "run" mud is very hard.

Some thin ss. layers are bright green. Mud runs cover the ss. ledges at frequent intervals in the lower half of the formation where clays greatly predominate, forming even, steep clay slopes, making the ss. ledges appear discontinuous, the clay slopes being uniform in appearance as though in original position. The clays, even where exposed "in place", show very little lamination.

In the ^{about} upper ^{middle} third of the formation thick massive sandstones, with a minimum of clay, produce ~~no~~ pronounced ledges. These sandstones include beds of conglomerate from which water worn pebbles of jasper and other hard materials thickly strew the slopes all the way down. The sandstones are mostly rather coarse. This and lack of lamination in the clay may account for absence of fossil

plants, conditions being unfavorable for their preservation. In the upper third colored clays again predominate, but with several thick sandstones which produce ledges.

The top of the mountain (up stream from where I crossed the creek) is covered and the upper slopes are well covered with large fragments of basalt, probably let down from the Grand Mesa flow before the cutting of the present creek valley began.

~~But~~ Near the top of the mountain numerous fragments of thin, light-colored ss. resting on colored clay may be base of Green River formation.

Looking across the valley to Horse Thief Mt. the Wasatch has a general reddish aspect with ss. ledges about the middle while the Green River has a whitish aspect, free from decided ss. ledges.

Gas. 4 gals.

In evening started for Del Norte to speak before convention of Federation of Women's clubs, on conservation of Natural Resources and Archaeology of the Southwest (with lantern slides).

Mesa, Colo. Sunday,

July 30, 1923.

Returned from El Norte this morning.

DeBeque, Colo., Monday,

July 31, 1923.

Gas. 4 gal. Speedometer 3624

Drove through DeBeque, up Roan
creek, and camped at mouth of Camp
Creek, 2.5 mi from DeBeque, Colo.

Foss. Sta. 9, near rim of gulch, in
oil shale, Green River, Eocene, insects and
plants. Gaudin shales in slide down
slope, may have come from a somewhat
lower horizon.

Moll. Sta. 417, at Foss. Sta. 9, dry slope,
dead shells of *Orsolobix s. depressa*.
very hot day

Roan Creek, Tuesday,

July 3, 1923

Hot partly cloudy

Fossil Sta. 10, Green River shale, ^{above}

Seller's Ranch, N. side Roan Creek W. of
Camp Gulch. Insects and leaves.

The fossils in this region seem to
be confined to the upper part of the
formation.

Roll. Sta. 418, aspen groves near
Forest. 10.

Rained in evening.

Roan Creek, Wednesday
July 4, 1923.

Another hot day.

Fossil Sta. 11, hill on E. side of mouth
of Camp Gulch. Plants & insects.

Erosion is progressing with great
rapidity in this locality. Slopes are very
steep, covered with loose shale talus broken
into flakes, making climbing extremely
difficult. Every storm sweeps great
quantities of shale down the slopes.

Many slumps, or landslides, occur in
wet weather, etc. There is a recent one
several hundred feet long opposite our
camp, another along the road a mile or
two down creek and many old ones south
of the creek.

Roan Creek Colo., Thursday,
July 5, 1923.

Broke camp and started for de Beque
Sta. 12; N. ^{E.} of John Vanduer's Ranch,
~~200~~ ¹⁸ mi. from de Beque, about 2 miles
below Highmore, in upper Wasatch,
same as Mrs. Cocherell's station of
1922. *Physa*, *Vivipara*, *Goniopsis*, *Limn.*,
etc., in 2 inch stratum in blocks weathered
from a six foot ss. about 100 ft. above
the road, probably not more than 300
ft. below top of Wasatch.

In afternoon we drove back up to
Highmore and camped.

Highmore, Colo., Friday,
July 6, 1923.

Drove up canyon 4 or 5 miles then
back to a 200 ft. cliff.

Sta. 13, foot Upper Green River shales
3 mi. above Highmore, in the high
cliff on E. side of Barr. creek; insects
and plants, larvae abundant. Below the

cliff gneiss and telioat scales occur.
Rained in afternoon - first one since
we crossed the ~~the~~ left Boulder that
has caught us away from camp.
Moll. Sta. 419, same as Foss. Sta. 13.
Archebius s. depressa, dead shells.

Highmore, Colo., Saturday
July 7, 1923.

Broke camp in morning.

Foss. Sta. 14, Upper Wasatch Escarpment,
about 1/2 mi. below Sta. 12, same
horizon, *Unio*, *Wainipara*, *Physa* and
Goniobasis, including 2 large pieces
containing *Unio*. This find may
possibly have been labelled Sta. 13
by mistake.

We examined the Upper Wasatch
farther down stream, but did not find
the fossil stratum and doubt its
presence.

Drove through DeBeque to the
Byram Ranch for Sunday
Rained in afternoon and evening

Mesa, Colo., Sunday,

July 8, 1923.

Rode up trail to about 8000 ft. or more on N. side Grand Mesa.

Moll. Sta. 420, aspen grove at highest point we reached. *Thyridophora*, *Vitruvia*, *Pupilla*. alt. 10500. *Byrrhus pastus*.

Moll. Sta. 421, rosebushes etc. & at ^{over} about 7500 ft. *Oreohelix s. depressa* and *O. cooperi*, abundant active during the rain. Rained at intervals all day.

Mesa, Colo., Monday,

July 9, 1923.

Drove through De Beque to Grand Valley, then North up Parashute Creek 11 miles where we camped at forks of creek.

Foss. Sta. 15, at forks of creek, in lower part of upper Green River shales, same lower horizon as at Sta. 13. (see next page).

Moll. Sta. 422; woods on dry, very steep slope at Foss. Sta. 15, shallow scattered

Amelanchier, & Vit. Mahogany - *Oroskly*
s. depressa, dead shells common. Did
not look for live ones.

coll. Sta. 423, bottomlands at camp,
beneath lentic in scrub oak grove,
Oroskly cooperi, large, abundant, active
after rain, on dead sticks - saw none
feeding on green foliage. Most of the
snails, ~~and~~ even the immature ones,
contained embryos, but not suffi-
ciently advanced to be ready for
ejection. Several albinos and some
very dark examples were obtained. It
is a very fine colony. The dry *O.*
s. depressa colony begins on
the slope 100-200 ft. above Sta. 423,
and the dead shells are found all the way
up the slope.

The larvae of Sta. 15- includes one long,
slender form and another much greater
diameter, which occur abundantly through
a considerable thickness of strata about
the middle of the Green River exposure
or higher. Another stratum contains great
numbers of small larvae. Both occur
at about the same horizon on Ralston and

barr creeks. On those creeks we found gamoid and teleost scales somewhat lower. These we have not found here. Also the pisolite which occurs on ^{Rain} ~~the~~ local seems absent here.

Above the larvae beds is a thick bed of shale which has been baked and a small part of it fused by heat, perhaps from the burning of the oil shale. Much of it is brick red, much of it yellow, while the thin fused stratum is black and porous, much resembling vesicular basalt.

Rained hard at noon and with light showers during afternoon and evening.

Gas. 5 gal. at De Beque.

Parachute break, Tuesday,

July 10, 1923.

Partly cloudy, sultry, but with a cool breeze at times.

Foss. Sta. 16, high bluff at S. point of divide between the middle and west forks of the creek. The usual larvae horizon below burnt shale, adult insects and leaves above the burnt shale at about

the same horizon as on ~~Robinson~~ and
Carr creeks. ^{↑ Roan}

The burnt shale is visible on all the
points here, but we saw none on Roan and
Carr creeks.

Any theory of the origin of the Green
River shales must account for the
change in sedimentation from the
Wasatch to the Green River. While the
boundary line is indefinite, on the whole
the Wasatch of this region ~~is~~ consists
of heavy sandstone ledges separated by
clay beds, often exhibiting little or no
stratification, variegated (red, green etc.),
and producing bad land topography. The
clay often runs down over the ss. ledges,
covering them with an even clay slope,
and baking hard, making the ss.
ledges appear discontinuous, the
ledges forming distinct benches where
well exposed. On the other hand the
Green River is composed almost entirely
of hard, laminated shales, very thin
bedded below, harder and partly
thicker bedded above, forming cliffs
in the upper part, the lower third

of the formation usually covered by a steep, uniform slope of fine talus.
Rain at noon, showers in afternoon.

Parashute Creek, Wednesday,
July 11, 1923.

Bright, hot morning.

Went up trail just south of Sta. 16, found lower horizon and obtained a few leaves and insects from the upper horizon, but they were inadvertently packed without labels in two packages.

Rained at noon.

Parashute Creek, Thursday,
July 12, 1923.

Bright & hot forenoon.

On way down creek to Grand Valley we examined a good exposure of upper Wasatch, but found no fossils. ^{much of the} ^{is a soft}

Drove to Rifle, then north to Rio Blanco, then W. down Picauro Creek.

coll. Sta. 424, 2 mi. below Rio Blanco,

dead breaking coopers along roadside - large
Fossil Sta. 114, same locality, lower
Green River shale, larval horizon, close to an
oil shale extraction plant, within operations.
Upper part of formation not exposed here.
No rain today, Green River beds dip
west here

Rio Blanco, Colo., Friday,
July 13, 1923

Bright, hot morning, rained late in
afternoon, cooler.

6 gal. gas. at De Beque.

We drove back to Rifle, then up
river to Newcastle.

Fossil Sta. 18, Mesa Verde Cret., first
galch. below bridge, on South side of
river, S.W. of Newcastle. Leaves in
hard, iron-stained sandstone - a thin
band. I visited this locality many
years ago, but the fine fossils we
collected then were lost!

Drove to Mesa in evening.

Rained in evening afternoon

near Rio Blanco, Saturday,
July 14, 1923.

Drove to Grand Junction, bought

supplies and pack saddle.
Rained in evening.

Mesa, Sunday, July 15, 1923.
Stayed at ranch all day - arranged
the packs. Rained in evening.

Mesa, Monday, July 16, 1923.
Did not get started today, as the
pack saddle obtained in Grand Junction
was too small for a horse, broke down
and got another.

Mesa, Bob, Tues., July 17, 1923
Left at 9 a.m. with 2 saddle horses and
2 pack horses, camped 20 mi. up Roan
Creek at 7 p.m. Hot, bright day

Ute Trail, Roan Creek,
Wednesday, July 18, 1923.
Hot day. Broke camp at 8:15 a.m.
and at 2 p.m. camped at head of

Wte trail out of Roan Creek Camp,
which leaves the creek at Sellers
Ranch, several miles above Camp
Gulch.

Moll. Sta. 425; foot of Wte trail,
O. cooperi, dead shells common; did
not search for live ones. North slope
under amelanchier, wit. mahogany, etc. oak
bush.


Moll. Sta. 426, ~~was~~ aspen grove at
camp head of Wte trail - several small
species.

Wte trail, Thursday

upper July, 19, 1923.

Sta. 19, ^{upper} Green River shale, Black Prince
oil shale dump about 3 mi. N. of N.
from camp. This is one of the Lockwell-
Ryeam localities of 1923.

Obtained a couple of leaves from another
dump about 2 mi. S. of Sta. 19.

Sta. 20, on point  about 1 mi. E. of
Sta. 19, on a dump.

saw 2 deer (buck and doe) and
one bear.

Ute Trail, Friday,

July 20, 1923

Sta. 21, Green River shale (upper) at E. point of ^{first} ridge S. of Ute trail, in oil shale dump - insects abundant, small.

Sta. 22, another dump 200 ft. E. of Sta. 21, about 25 ft. lower - plants abundant.

Sta. 23, lower than Sta. 22 - larvae horizon, along Ute trail, across gulch due N. of Sta. 22, shale dump

Sta. 24, higher horizon, 1/4 mi. W. of last Sta., on Ute trail, shale dump.

Rained in evening

Ute Trail, Saturday,

July 21, 1923.

Rode S. to head of Kimball creek,

Sta. 25, first shale assessment dump, upper Green River shale, insects abundant.

an dump at a lower horizon was barren.

Sta. 26, upper Green River shale,

oil shale dump about 2 mi. W. of
Sta. 25, at head of gulch heading
W. of Sta. 25 and running S.W. to
Grand River Valley along a good trail
leading into valley, possibly east fork
of Salt Wash.

Ute Trail, Sunday,
July 22, 1923.

We examined several oil shale
assessment dumps S. of camp
but found nothing.

Then John started down the trail
with a pack horse loaded with
fossils to be left at Sello's
Ranch.

Ute trail, Monday, July 23.

Broke camp at 9:20 and started N.W.
along the trail, up the divide about 15 miles
where we found a little water at the head of
a gulch between ^(head of Basin Creek) Soda and Douglas
Creeks (probably ^(can)) and camped at 2 P.M.

The plateau is covered for the most
part by aspen groves, thickets of

scrub oak and service berry and large patches of sage. Rabbits were common in the valley, but have been none since we started up the trail. Dusky Grouse very common - young well able to fly.

The canyons dissecting the plateau have very steep slopes, difficult to climb on account of the fine, sliding talus with frequent impassible ledges and cliffs. At the rim the country slopes upwards more gently for several hundred feet, affording no good exposures of the upper part of the formation, but there are indications that it is largely shale, with thin, hard sandstone layers several inches thick. Fragments of ss. are everywhere present on the surface.

Mt. St. 427, south facing slope fairly well covered with small shrubs, just across from camp - *Oreohelix cooperi*, large dead shells common; found none alive. ^{see below}

On the trail today, saw no shale dumps and no good exposures after passing State 19, except 2 or 3 dumps examined by Lockwell and Byram last year.

Moll. Sta. 427 - later I found a few live ones, active a few hundred yards around the hill on an east-facing slope, after a slight shower.

Sta. 27, upper Green River shales, bluff just below camp in tributary of ~~Roan~~ (2.) creek. bare blocks

Rained hard in evening.

Head of ~~Roan~~ ^{bare} creek,

Tuesday, July 24, 1923.

Sta. 28, bluff jutting out into what we take to be Douglas creek, most prominent bluff on E. side of canyon, about 1 1/2 or 2 mi. W. of camp - lower horizon is the larvae horizon. This extends to the top of the exposure on the bluff, hence the upper half of the formation is eroded away. No other fossils found.

To the north we can see what must be the White River valley and evidently with no Green River beds exposed. One bluff looks like Mancos.

Mollusk Sta. 428, about 2 mi. down ^{bare} Roan creek from camp, probably found

alive by Byron.

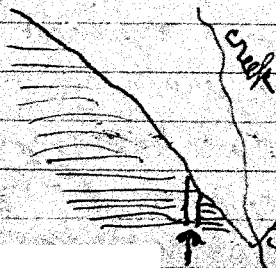
Barr, Creek, Wednesday,

July 25, 1923

Rained hard in night and this forenoon until 10 o'clock. Then we broke camp and started down divide N.E. of Barr Creek, about 10 or 12 miles. Turned from trail found fine water in a gulch running into Brush Creek and camped with a U.S. land survey party under Mr. _____.

Have seen 3 or 4 oil shale dumps in the last few miles, but not favorable for fossils and no ^{good} exposures of the fossiliferous beds.

At camp a fine example of slumping by a clean break, ~~is~~ is exposed by a shale excavation.



Place marked by arrow is the break, filled with debris

The surfaces of the slumps constitute so important a factor in the rapid erosion of the shelves as long

Roan Creek and elsewhere are usually very irregular and broken, but possibly underneath they would show as clear a fault plane as here in this ~~so~~ small one. We have seen several large ones (several hundred feet long) which have occurred this year and may still be moving slowly, also the Wasatch on the headwaters of Douglas Creek and on Salt Wash? W. of our camp at head of Vte trail shows extensive slumping.

Rained a little in evening.

We are getting lower, so the aspens and spruces are mostly confined to the gulches, especially the north slopes, leaving large sage brush areas on the divides.

Brush Creek, Thursday,
July 26, 1923

Bright morning.

Rode back to camp and travelled six miles along the trail on the divide between bare and Brush creek. Terrible thunder storm with hail occurred. Then turned down a very steep, sinuous, narrow trail down the canyon wall to Brush creek, down Brush creek to Roan at Old Highmore Hall (not Highmore P.O.), down Roan to DeBeque at 8 p.m., a 40 mile ride without stopping.

Went to hotel and got rooms.

Sta. 29, along steep trail down into Brush creek, larvae horizon well exposed in Green River shales. Reached from horse and picked 3 or 4 examples from a ledge.

DeBeque, July 27

Came to Mesa this forenoon.

Very hot day.

Mesa, Colo., July 28

Drove to Colburn for hobbles and supplies.

Mesa, Colo., Sunday,

July 29, 1923

Bright, warm day. Stayed at ranch

Mesa, Colo., Monday, July 30

Bright, cool morning, soon warming.

Started for Grand Mesa with saddle and pack horses at 8:45 a.m., aneroid reading 5700 ft. at Mesa Lake 9700 ft. Stewart's pasture, 4 mi. ^{N.E.} from Mesa Lake, 9850 ft.; in N.E. edge of Big Park - a forest reserve lease, with old cabins.

Open parks and aspen groves, with a few spruces, water plentiful and good.

Trail from Mesa Lake to camp is along the lower bench below the rim. Hummocky topography, with numerous completely enclosed basins, occupied by lakes and ponds and apparently moraines, make it almost certain that the region is glaciated. Glaciers probably originated along under the cliffs of the rim from drifting snow, and spread along the lower bench as the

directions of prevailing winds. Large snowbanks still hang just beneath the rim until late summer and in places the year round.

Sprinkled in late evening.

Big Park, Tuesday,
July 30.

Moll. Sta. 429, Frank Barnes Reservoir W. edge Big Park, a shallow natural reservoir, with slight enlargement by a dam. Water low now, mud bottom, about 100 x 75 ft. diameter.

at rim on trail above S.W. of Mesa Lake aneroid reads 10350

Moll. Sta. 430, pool ^{on mesa creek} below Mesa Lake at Ranger Station, *Pisidium* abundant, *Lymnaea* rare.

at Stewart's cabin out on W. point of Mesa, aneroid 10000 ft.

Sta. 431, about same altitude, head of Deep Creek, on top of Mesa. *Lymnaea* abundant.

Aspen groves on top replaced by conifers.

Sta. 432, vegetation filled lake near head of reservoir creek, alt. 10550.
Pisidium and *Planorbis*.

This reservoir is just back of a glacial moraine. From here to where the bottomland trail starts down to Mesa Lake the mesa is heavily glaciated - moraines, drumlins, enclosed basins and finally at the highest point near the rim (10750) very fine rock moutones.

Sta. 433, between camp and Mesa Lake, *Oreohelix cooperi*, a few dead shells, two alive on trunks of aspens, one six feet above ground.

Rained hard late in evening

Grand Mesa, Wednesday, Aug. 1

Sta. 434, ^{large} vegetation choked lily pond where the trail to the W. end of the mesa starts to climb the wall of the rim, aneroid 10,050 ft., *Pisidium* and *Planorbis*, scarce. - about 1 to 1 1/2 mi. S.W. of Mesa Lake

Sta. 435, shallow pond, 6-8 inches deep, 50 x 75 ft. diam, mud bottom, no vegetation, *Pisidium* common, a few hundred yards ^{east} of 434

Sta. 436, ^{large} lake bordered by angular rock, with little mud and no vegetation, a few hundred yards S.E. of 435. *Physa*

Sta. 437, small, vegetation choked

slough $\frac{1}{4}$ mi. E. of Ranger Station, *Pisidium*
& *Lymanaea* abundant

Sta. 438, Jumbo Reservoir, E. of
Sta. 437, *Physa* very abundant, no vegetation
in water

Sta. 439, grass-choked slough pond
below dam of Matedog Reservoir, alt. 10,000 ft.,
E. of Ranger Station; Large *Planorbis* and
Lymanaea common, a few *Pisidium*
Rained hard in late evening

Grand Mesa, Thursday, Aug 2

Sta. 440, lake fringed with water lilies
 $\frac{1}{4}$ or $\frac{1}{2}$ mi. E. of # 339. *Pisidium* not common

Sta. 441, lily pond S. of fire, very narrow,
high moraine over which our trail passes
N. E. of 440; very large *Planorbis* rare; *Pisidium*
common, Pond open except for water lilies.

Sta. 442, just across moraine N. of
Sta. 441; large *Planorbis* and *Musculium*
both abundant. Pond choked with vegetation
Two small *Lymanaea*, probably *Lymanaea* ^{or *Musculium*} under No. 441

a small pond to the E. over another moraine
yielded nothing

all these lakes are glacial

Sta. 443, small lake free from vegeta-

tion perhaps $\frac{1}{4}$ mi. N.E. of 442; caddis larvae cases composed of small *Pisidium*.

Sta. 444, small pond, free from vegetation, about $\frac{1}{4}$ mi. N. of 443, along trail, near edge of Big Park. *Lymnaea*, one example of a species I do not recognize.

No rabbits since we left the valley.

Long slough in S. edge of Big Park, is evidently held by a long, low moraine. Most of the moraines nearer the cliffs are narrow, high & steep. Found no mollusks.

Sta. 445, lake in Stewart's pasture in Big Park, $\frac{1}{2}$ mi. E. of camp. *Planorbis* ^{interioris} large thick shelled, abundant; ~~Planorbis~~ *Musculium* small, very abundant; *Lymnaea*, numerous old, dead shells, only 2 or 3 found alive; a few *Planorbis* of ~~Stewart's~~ ^{parvus} type and caddis cases composed of them.

Rained at intervals all day and evening a little.

Grand Mesa, Friday, Aug 3.

Partly cloudy forenoon.

Broke camp at 9 a.m., left Mesa Lake for top by Alexander Lakes trail.

Sta. 446, lake on trail about ^{or more} 2 mi.
from Alexander lakes, alt. 10750 ft.; *Pisidium*
abundant; lake from vegetation. This lake
is near where the trail starts down to
Alexander Lakes.

Camped at Alexander resort. Rained a
little in evening.

Grand Mesa, Sat., Aug. 4

Rode up trail to Island Lake, first one we
reached after leaving the rim. Recently enlarged.
No mollusks found. alt. 10350 ft.

Sta. 447, Island lake, just below
Bark Lake, just below Island Lake,
Pisidium common.

Sta. 448, lake $\frac{1}{2}$ E. of 447. *Pisidium* common;
a few dead *Physa* seen

Sta. 449, Ward Lake. *Pisidium* common.
alt. 10300 drains W. Other drain E.
Original direction of drainage of Sta. 447 & 448
is E., but at Alexander Lake drainage abruptly
changes to the W. through Ward Lake.

Yesterday we saw a very fine buck and
doe as we left our former camp.

Pine grosbeaks very common above

our present camp.
Rained at intervals during afternoon
and evening.

Grand Mesa, Sunday.

Aug. 5.

Sta. 450, Barrow Lake, just below
camp; *Pisidium* and *Planorbis* scarce;
Lymnaea common; *Physa* a few.

alt. ~~8500~~ 10300 ft.

Rained at intervals in afternoon.

Grand Mesa, Monday, Aug. 6.

Broke camp and travelled 5 mi. to along
road to Coburn, turned off on Stoll Reservoir
trail - ^{at Military Park Reservoir,} an old wagon road long unused

Sta. 451, lake $\frac{1}{2}$ mi. N.W. of Stoll
Lake Reservoir, alt. 11050 ft. *Pisidium* fairly
common.

Small then turned back to road.

Sta. 452, pond $\frac{1}{4}$ mi. S.W. of 451;
Pisidium abundant, *Planorbis* common,
Lymnaea (very small), scarce; alt. 11,100.

Found no mollusks in Stoll Reservoir.

Camped on creek half mile E. of Military
Park Reservoir.

Sta. 453, large reservoir just below
camp. *Lymnaea* ~~teballei~~ very abundant
in one small inlet about 3 ft. square. alt.
10,300 ft.

Clear nearly all day; no rain.

Grand Mesa, Tues., Aug. 7

Broke camp and resumed march along
boburn road, turned off at Big Creek and
proceeded past bottomwood lakes ~~to~~ and
camped in Byrnie's pasture. all along way
is glacial phenomena - moraines, hummocks,
lakes, ponds, etc. Glacial cirques not
evident.

Sta. 454, small, grass-choked pool
where trail leaves Big Creek. *Pisidium* abundant.
alt. 10,400 ft.

alt. at evening camp 10,600 ft. No rain

Grand Mesa, Wed., Aug. 8

Rode back to bottomwood lake country,

Sta. 455, ^{Little} Crystal Lake, 10,700 ft.

Pisidium abundant.

Sta. 456, lake S. E. of 455; *Physa* and
Pisidium abundant.

Sta. 457, beaver pond just below waterfall from Bottomwood Lake No. 1.

Pisidium abundant, a few *Lymnaea*.

Sta. 458, Bottomwood Lake No. 2,

Pisidium abundant. alt. 10,500 ft.

Sta. 459, small, vegetation-choked pool in No. 2 Park, $\frac{1}{4}$ or $\frac{1}{2}$ mi. W. of Sta. 458.

Pisidium common.

Sta. 460, pond, partly grass-grown ~~at~~ $\frac{1}{2}$ mi. N. of 459, - *Lymnaea* abundant, *Pisidium* scarce.

No rain today

Grand Mesa, Thurs. Aug 9.

Sta. 461, Bull Creek Res. No. 1, *Pisidium* abundant. Physes one, *Lymnaea* few.

Sta. 462, Bull Creek Res. No. 2, *Pisidium* common, large.

Sta. 463, Wheeler Reservoir, W. of 462 *Lymnaea* abundant, *Pisidium* scarce.

Sta. 464, lily pond $\frac{1}{2}$ mi. N. of Bull Creek No. 3 reservoir. Planorbis very abundant, *Pisidium* few. *Musculium* congregated in great numbers under logs at one end of pond.

Revisited the mesa & got more Planorbis.

There are many beautiful remains here -
boats - high, narrow, steep sided, ^{in a line of supply} impinging
upon each other at various angles, indicating
many changes in shape of fronts of various
glacial groups. Probably at one time, perhaps
most of the time there was one continuous
glacier along the N. rim of the mesa, leaving
no pronounced cirques, but ~~at~~ the terminus
probably fluctuated greatly as drifting
winds fluctuated in velocity and direction,
more snow accumulating at ^{some} ~~one~~ points under
the rim than others, and points of maximum
accumulation varying.

Rained a little at intervals.

Beaver work abundant. They had built
a dam over the spillway, raising the ^{the} of one
reservoir, raising the water to danger point
so we tore it out.

Grand Mesa, Fri. Aug. 10.

cloudy, sprinkles at intervals

Sta. 465, Bull Creek Res. No. 5 enlarged
fluctuating greatly. A few *Lymnaea*.

Sta. 466, Beaver Pond below Bull
Creek Res. No. 3. *Lymnaea* common.

also collected tree toads just losing
their tails.

Sta. 467, pond 1/2 mi. N.E. Bull Creek
Reservoir No. 3. *Lymnaea* common,
Pisidium scarce.

Sta. 468, completely isolated pond
E. of 467. *Lymnaea* common

Sta. 469, pond N.E. of 468. *Pisidium*
scarce.

Camp is at Sta. 420, collected *Vertigo*
or *Sphyradium* in quantity, and a few
Vitrea here today, all active, on dead logs,
sticks and old leaves.

Has rained at intervals all day.

Mesa, Bob. Saturday,
Aug. 11, 1923.

Cloudy morning. Broke camp and
returned to Ryan Ranch. In afternoon
returned horses to Art Johnson and
brought back specimens which Erwine
Stewart had brought down from Mesa
Lakes for us.

Mesa, Bob. Sunday,
Aug. 12, 1923

Cloudy morning

Spent forenoon reading mail, writing
letters, packing specimens, etc.
Rained afternoon

Mesa, Colo. Monday,
Aug. 13, 1923

Rode N.E. to Horseshoe Mt.

Sta. 30, ^{same as 32 below} coarse ss just above Ruby
formation, upper ~~part~~ or lower
Green River Escarp. Part of mammal jaw.
Loose rock not in place, about 100 ft
higher another rock, evidently from a thick
ledge in lower Green River, contained a tooth.
visited Sta. 1 and got more *Planorbis* and
Physa. Also No. 2.

Sta. 31, just below cliff at top of Horseshoe
Mt. Insect larvae horizon, as on Palitou Creek,
large bot-fly larvae below, more slender
larvae above.

Much thin ss. containing siliceous
pebbles in lower half of formation; also
conglomerate composed of shale fragments;
also ripple marks; all indicating stream
deposition, or near shore if lacustrine.
All regularly bedded, strata traceable
for long distances. Mammal bone frag-
ments + fish bones abundant in lower half

If a lacustrine deposit, the lake should have been full at all times to the lowest point in the rim of its basin. As thick beds overlie the drying cracks and ripple marks and they are far from the edge of the formation, how could exposed surfaces permit drying cracks or shallow water permit ripple marks, unless arid conditions caused temporary recessions of the water. Erwin Stewart reports crossbedding
Rained in afternoon.

Mesa, Colo., Tuesday,
Aug. 14, 1923.

Bright morning, rained before noon and in afternoon.

Drove to De Beque and shipped six boxes of specimens by freight and John's trunk and suit case by express.

Mesa, Colo., Wednesday,
Aug. 15, 1923

Rained most of day, so we remained at the ranch.

Mesa, bob, Thursday,

Aug. 16, 1923

Left ranch at 8 a.m.

Looked for Lee's Tubotoma locality in the upper Mesaville bed. $1\frac{1}{2}$ mi. N. E. of Banner, but could not get over the upper cliff, so did not find it.

Also examined Lee's locality $3\frac{1}{4}$ mi. N. E. of Palisades, but found nothing. Map not accurate here.

Drove to Palisades, then ^{2 or} 3 mi. S. E. and camped dry, with greasewood for wood. Hot dry day.

Palisades, bob, Friday,

Aug. 17, 1923.

Another hot, dry day.

Sta. 37, a mi. S. E. of camp, 200-400 ft. below top of Mancos Crst. sh. & limestone concretions filled with brachiopods & Trilobites but weathering into small fragments, making good specimens impossible. Also found one small Lingule, some *Pteris*, *Anomia* and *Loricina*. Thin ss. layers higher contain *Halymerites* which is also abundant in the Rollins ss. and

Bowie shale, which is here mostly ss.
We worked up over the Rollins and
Bowie and into the Paria shale and
found nothing else, though Lee reports
a number of species of plants and
invertebrates.

Saw a collared lizard on the cliff
banyon werens common.
Dined with the Swiskeys in the evening.

Whitewater, Colo., Saturday
Aug. 18, 1923

Cloudy.

Drove to Grand Junction, dined with
Bailey, grocerman, then S. to Whitewater
Sta. 33, bluff a mi. E. of road at
Whitewater Hill, dark shale below weathering
yellowish above, Mancos bet. *Aster*
congesta.

Camped on Gunnison River near
mouth of Whitewater.

Rained in evening.

Whitewater, Colo., Sunday,
Aug. 19, 1923.

Moll. Sta 470, ditch W. of Whitewater.

Lymnaea small, abundant, many of them
on plant stems and mud, out of water,
mostly in water.

Fossil Sta. 34, Lower Manos cret.,
below the scaphite horizon ^{Sta. 8 June 23} S. of Whitewater
Hill, in coveritinary horizon, *Ostrea*
soleniscus. Just above it in thin bedded
ss. are pieces composed of spicules
like prisms of *Suoceramus*. The ss.
contains *Suoceramus cf. dividius*, *Ostrea*
lugubris and small cephalopods.

Rained hard in late evening.

Kannah Creek, Colo. Monday.

Aug. 20, 1923.

Drove up Kannah Creek to intake of
Grand Junction and Palisades water work
system, then across to head of North Kannah
Creek to

Fossil Sta. 35, Lee's loc. "9 mi. S. E. of
Palisades, at old coal mine. Leaves poorly
preserved and gastropods much crushed,
1000 ft. below top of Mesaverde.

Fossil Sta. 36, on Whitewater road, 2 mi.
N. of Kannah Creek, Lower Manos cret.,
same horizon as above Sta. 34; *Ostrea*

Lugubria, *L. dimidiata* & *Prionocyclus*.

Moll. Sta. 471, ditch near where road to Delta crosses Kannah Creek. Small *Lugubriae* abundant.

Drove to Delta and camped in city camp ground. Hard rain at Delta.

Paoia, Colo., Tuesday,
Aug. 21, 1923.

Drove to Paoia and camped in City Park.

Visited coal mines N.W. of city but found no fossils and not good exposures of rocks.

Moll. Sta. 472 at the coal mines, dead *Oreobolus* & *depressa*, common. Rained in afternoon.

Paoia, Colo., Wednesday,
Aug. 22, 1923

Bright, cool morning

Moll. Sta. 473, slough by roadside just below Paoia. *Physa*, *Lugubria* and *Planorbis*, abundant, small.

Moll. Sta. 474, spring choked with algae and grass, 4 mi. W. of Hatching. Small

Physa abundant.

Foss. Sta. 37, lower Mancos cret., the *Ostrea lugubris* horizon, about 5 mi. W. of Hotchkiss on road to Delta.

Foss. Sta. 38, about a mi. W. of Sta. 37, about 60 to 100 ft. above hard upper Dakota ss., *Gryphaea newberryi* abundant.

Foss. Sta. 39, 100 ft. or so above Sta. 38, *Jucosaurus divinduis* + *Ostrea lugubris*, as usual above a concretion zone.

Moll. Sta. 475, roadside slough 1 mi. S. E. of Olathe on road to Montrose, small *Gymnaea* and *Physa* common.

Drove to Montrose, then east and camped at Bimmaron.

No rain today.

Bimmaron, Colo., Thursday.

Aug. 23, 1923.

Bright, cold morning

Foss. Sta. 40, just above Bimmaron Mancos bet. *Ostrea congesta* on *Jucosaurus*

Moll. Sta. 476, 1/2 mi. from Bimmaron on Gunnison, in aspen, alt. 8400 ft.

7 or more species of land snails.

Moll. Sta. 477, backwater from creek
just E. of Sapinero's. *Lymnaea* abundant.
Moll. Sta. 478, slough below road in
Gunnison valley, 6 mi W. of Gunnison.
Physa abundant.

Drove to Gunnison and camped.
No rain today, cool.

Gunnison, Colo., Friday,
Aug. 24, 1923.

Moll. Sta. 479, slough 4 mi. W. of
town, along roadside. *Physa* and *Lymnaea*
s. affinis scarce, *Succinea* abundant on
muddy bank.

Sta. 480, ditch just S. of town,
small *Planorbis* and very small *Lymnaea*
(abundant).

Sta. 481, slough, 2 mi. N. of town.
Lymnaea and *Aplysia* common, small
Planorbis abundant.

Sprinkled a little in afternoon.

Gunnison, Colo., Saturday
Aug. 25, 1923

Hazy, cold morning.

Sta. 482, 13 mi. E. of Gunnison on
Monark Pass road. *Physa* abundant.

alt. 7,900 ft. slough
Sta. 483, 32 mi. E. of Guimisson
in slough. *Physa* common.

Crossed the mountains at Monark Pass
and drove to Salida. Camped in grove near
Poucho.

Heavy rain on east side of divide
Took pictures of weathered porphyry
like rock shortly after leaving
Guimisson.

Poucho, Colo., Sunday.

Aug. 26, 1923.

Remained in camp. Rained in afternoon.
Moll. Sta. 484, spring at camp. *Pisidium*
abundant. Very small *Physa* common, one
or two very small *Lymnaea*.

San Luis Valley, Monday.

Aug. 27, 1923.

Bright + warm.

Drove south over Poucho Pass.

Moll. Sta. 485, ditch 4 mi. N. of
Hooper. *Lymnaea* abundant. *Physa*
Scissa. *Fluminicola* or something of the
sort ^{is *Fl. cockerelli*} abundant.

Moll. sta. 486, slough 1 mi. N.W.
of Hooper. Leguminosae abundant.
Sta. 487, ditch 4 1/2 mi. E. of
Alamosa, Physa and large Leguminosae
abundant. L. cockerelli scarce
(485) may be L. cockerelli.
No rain. Camped at Alamosa.

Alamosa, Colo., Tuesday,

Aug. 28, 1923

Started West. Bright morning

Moll. sta. 488, ^{cattail} slough about 1/2 mi. E.
of Monte Vista. Small Planorbis abundant.
A few Leguminosae.

Sta. 489, pool by roadside about
2 mi. E. of Monte Vista. Small
Planorbis common, Leguminosae abundant.

Sta. 490, slough 1 mi. N. of Monte Vista.
Planorbis trilinearis, P. epaeus (1 dead empty),
P. uva jarvisi, Leguminosae s. appressa, Physa
valvata and Musculium

Sta. 491, slough 4 mi. E. of Del Norte;
small Planorbis, small Leguminosae and large
Physa abundant.

Sta. 492, slough 1 mi. E. of Del Norte;
Physa abundant; a few small Leguminosae.

Sta. 493, ditch 1 mi. W. of Del Norte;
Apleta and *Lymnaea* common.

Sta. 494, slough $\frac{3}{4}$ mi. N. of
Del Norte, *Lymnaea* abundant.

Camped at Del Norte, alt. 7880 ft.

Lake Santa Maria, Colo.,
Wednesday, Aug. 29, 1923

cloudy, cold day.

Drove through breed and up river.
Camped about 4 mi. N.W. of Lake Santa
Maria on Clear Creek.

Moll. Sta. 495, pool a mile S. of camp.
Lymnaea and *Pisidium* abundant.

Visited alt. 9500 ft.

Lake Santa Maria,

Thurs., Aug. 30, 1923

Visited the lake, type loc. of Plavie's
Apleta sp., but found no mollusks. The
lake has been greatly enlarged for
irrigation purposes, and has a fluctuation
of over 25 ft., the present level being
that much below high water mark,
and stumps & shrubbery indicates

that it is now considerably above former level. New shore line not favorable.

Moll. sta. 496, rivulet along road where Lake City road leaves the river, alt. $\approx 9,300$ ft. *Pisidium* abundant, *Lygus* scarce.

Camped at Sel Norte. Rained in afternoon. Snow on hills.

Sel Norte, Colo. Friday,
Aug. 31, 1923

Moll. sta. 497, ~~7~~ ⁷/₈ mi. W. of Mount Vista on main Sel Norte - Mount Vista road, S. of river, in ditch.

Lygus common.

Moll. sta. 498, 5 mi. E. of sta. 497. *Lygus* abundant. - 1 mi. W. of Mount Vista.

Camped at Alamosa.

No rain.

Alamosa, Colo. Saturday,
Sept. 1, 1923.

Drove to San Luis lakes.

Moll. sta. 499, San Luis Lakes, very shallow, in sand dune country, near the great dunes. No mollusks.

found alive, a small Planorbis very abundant everywhere on shore. Large Planorbis and Lymnaea fairly common. Two dead Aplexas. A few Physas. I believe Supersall reported Valvata here, but we found none.

Rain in afternoon with cold wind. Camped above Poucho.

Poucho, Col., ^{Sunday} Sept. 2, 1923.
Bright, crisp September morning.
Stayed in camp all day. No rain.

Banyon City, Col., Monday
Sept. 3, 1923.

Bright morning.
Drove to Banyon City and camped.
Collected some of the Ordovician fish plates at quarry close to river just above town opposite old hotel.

Bañon City, Colo., Tuesday
Sept. 4, 1923.

Collected fossil mollusks from just below the horizon from which

dinosaur bones were obtained years ago at Garden Park, about 8 miles north of town, the place mentioned by White in his bulletin on fresh water Jurassic fossils, but we found none of the kind. The fossils are in a cherty limestone in shales 10 or more feet below the bone sandstone and quite a way above the base of the Morrison formation.

Also obtained a few fossils and some selenite from the Pierre shale 4 mi. N. of town.

Moll. Sta. 500, reservoir 4 mi. N. of Cañon City - *Planorbis trivolvis* and *Physa* sp. common - only dead shells taken.

Hot, bright day.

Florence, Col., Wednesday
Sept. 5, 1923.

Drove to Florence and examined the formations S. W. of town. Many leaves in the sandstones above the coal, but the rocks split irregularly so we got no good specimens.

Then drove south east through Pueblo.

Moll. Sta. 501, small roadside pool
10 mi. E. of Pueblo, N. of river. *Lymnaea*
cockerelli abundant, many of them out on
the muddy bank above; pool about
5 by 10 ft. in diameter.

Fowler, Col., Thursday,

Aug. Sept. 6, 1923

Drove east to La Junta and worked back
Moll. Sta. 502, pond in city park at
La Junta. *Physa* common.

Sta. 503, roadside ditch one mi. W. of
Swink. Small *Lymnaea* and *Physa* abun-
dant.

Sta. 504, Holbrook reservoir, 4 mi.
N. of Swink. One bleached shell of *Planorbis*
trivolvis, lake new and very shallow at
margin.

Sta. 505, shallow lagoon about 1 mi.
W. and 6 mi. S. of Rocky Ford. *Lymnaea*
cockerelli and *Physa* abundant.

Sta. 506, Swink Res. N. of Mangawla.
Physa scarce, shore unfavorable, very
shallow, fluctuating
Rained in evening.

Expense - collecting trip.

Summer of 1921.

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Continued from preceding notebook.

July 25: Lakeville, Woodward & North, gas & oil	2.15-
" 27 Montpelier, Bar Lake Motor Co., gas & oil ^{2.45} .60	3.05-
consol. wages & machine Co., Straizer	.25-
Lava Hot Spr., Capital Garage, repairs & supplies	3.55-
Lava Motor Co. " " "	6.30
Pocahontas, Yellowstone Motor Co., gas, oil, grease	2.60
Idaho Falls, Baker & Co., strainers	.80
Refrigerator - Co. Op. Grocery, lemons	.28
Madison Garage Co., oil & gas	1.50
St. Anthony - Fremont Auto Co., gas & hauling	3.00
Chester - gas & casing	14.15-
West Yellowstone - Entrance	7.50
Yellowstone Park, gas & oil	2.40
gas. 1.20 gas & oil 2.00 ditto 1.85	5.05-
gas & oil 2.00 repairs 6.75-	8.75-
Moran, Wyo., gas & groceries	4.75-
Cody, Wyo., gas, oil, grease & repairs	2.65-
" milk & doughnuts	.30
" repairs 3.00 2.05 meals 1.00	6.05-
Basin, Wyo., gas & oil	1.70
Ten Sleep, Wyo., meals	1.20
Lodgepole, Wyo., repairs, oil & gas	26.75