


Junius Henderson
Field Notebook
No. 8

July 22, 1916-
Sept. 1919

Junius Henderson

Boulder,

Colorado

Note  Book

No. 8.

Newcastle, Colo., Saturday,

July 22, 1916.

Reached here from Provo, Utah,
this morning at 5:45 a.m.

Daniels & I walked up Elk Creek
to the old ~~Peebles~~ Peebles Ranch, now
owned by Fr. Vidanna, just above
the forks of the creek, on the west
fork.

Sta. 128. Creek bottom and S.
slope of ~~Halley~~ canyon S. of the
Vidanna Ranch house. *Oreohelix*
depressa, dead shells abundant
on steep slope of Mesa Verde sand
stone and shales (N.E. slope of Grand
Hagback), ~~no~~ leaves mostly washed
from beneath the shrubbery, but
two live *O. depressa* found. Under
leaves at edge of cottonwood grove
at northern edge of creek bottom
below Vidanna ranch we found
live *O. depressa* abundant at ~~one~~
one place. Also *Pyramidula*,
~~Sta. 129.~~ *Louitoides*, etc.

Sta. 129. Dry slope of Maunaloa shales, N. side of gulch, N. W. of Vidanna's house, type locality of *Oreohelix hendersoni* dahani. These snails ~~was~~ are abundant under a pair of the scattered bushes, wherever the bushes hang low and afford good cover.

Glenwood Springs, Colo.

Sunday, July 23, 1916

Reached here last evening at 3:35.

This morning we visited the type locality of *O. h. betheli*.

Sta. 130, point opposite N. end of pipe line trestle over Grand River, Glenwood Springs, Colo. *O. h. betheli* at edges of limestone slides under shrubbery, but especially abundant under small native box elders about one slide. Boxes abundant for half a mile along the mountain side.

Sta. 131. Foot of Mts., ~~W. side of~~ E. side of valley, about a mile S. of Glenwood Springs. *O. h. dahani*, some of them banded, perhaps *O. s. depressa*, at edges of scrub oak groves, a few alive. Bores all along base of mts. into town.

Hot forenoon, rained and hailed about 3 p. m.

Glenwood Springs, Colo., Monday.
July 24, 1916.

Sta. 132. S. side of Grand River, 1,00 yds ~~above~~ pipe line across river, ~~near~~ opposite Sta. 130. *O. h. betheli* varying toward *alta*, abundant on slope at foot of ^{limestone} cliff, under very small shrubs and in tall grass, abundant, active after rain. We traced this colony up to the small ravine at the end of the pipe line. Not in rock slides.

Sta. 133. Next small ravine, due S. of 132, which comes out a few

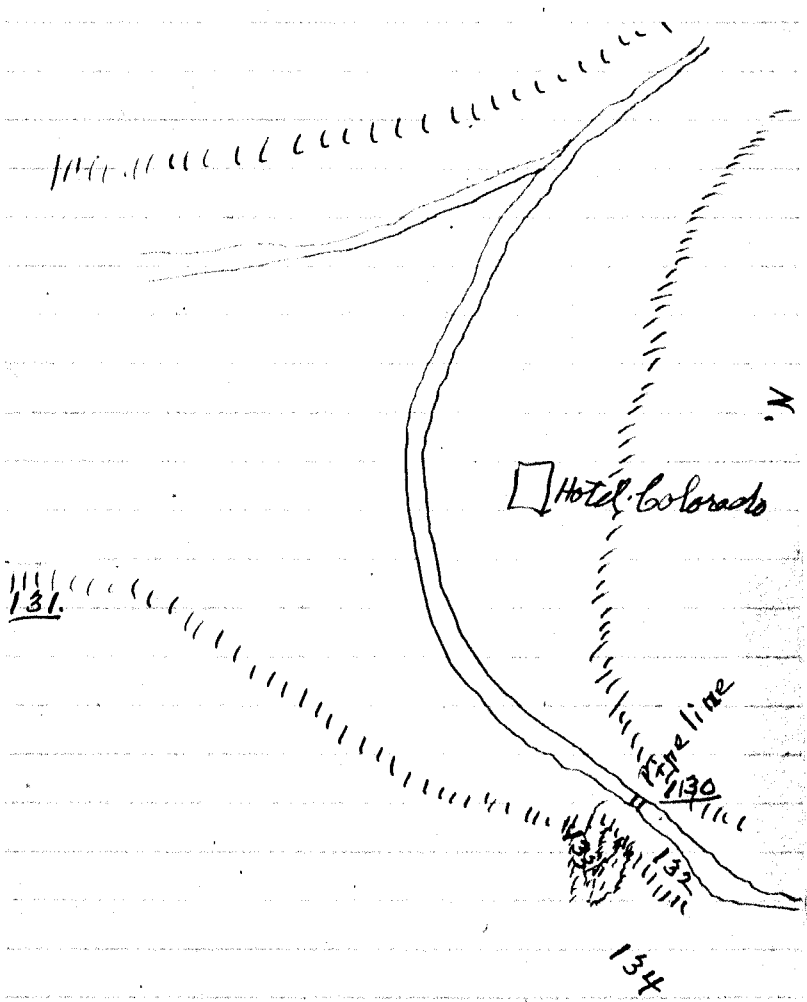
rocks below (s. w.) of the end of the
pipe line hanging bridge. *O. h. betulae*
form *alta* common, active, dead
shells numerous. Some dead ones
as coarsely ribbed as typical *betae*,
but live ones mostly quite smooth.
Three dead reversed shells, 2 broken.

Sta. 134. Slopes above # 133.

O. h. dakani, under shrubbery.
A number of reversed shells found,
two or three of which are alive.
This colony continues along the
mountain side to Sta. 131.

Revisited Sta. 130, but found few
snails, though those found were
active. Sun had dried the slope.

N



N

131.

130
Fire line

133

132

134

Automobile Ford.

May -	1917,		50.00
"	28	"	50.00
"	"	"	license
			2.38
"	"	"	extras, etc.
			74.13
"	"	"	Ins.
			11.25
July	25	"	2 payments, July & Aug.
			160.00
Sept.	8	"	1 " Sept.
			90.00

Wyoming

Norman Gehring - Shell Creek, Wyo.

Mouth of ~~Shell Creek~~ White Creek, a tributary of Shell Creek.

Moss encrusted with lime

Mrs. J. F. Boybu, 5 mi. E. of Shell, sister of Norman Gehring. - at mouth of White Creek

MacKenzie, oil man, Shell and Greybull.

See Walker localities

Bone cave, Ten Mile Creek, 10 or 15 mi. W. or N.W. of Worland. Go up creek to fork, then just past fork up W. branch (not N.W. branch), then 3/4 mi. S.W. Cave easily found. Bones & teeth common in and around it. Bad lands. E. of Bighorn Mts.

Ten Mile & Fifteen Mile creeks.

Bad lands - bones abundant - Thousands of fragments

Six mi. E. & 1 mi. N. of Worland.

Big bones in bank on east side of "hester-covered foothills."

Five mi. N.W. of Hyattville, alkali creek region

Shells abundant - a wrinkled oyster,

Gryphaea sp., Beudanticeras sp.

Wyoming - continued

Don Walker - continued.

Shale hills S. of Bonanza, on Norwood creek.

Calappa demeyi very perfect.

3 1/2 mi. E. + 4 mi. N. of Bonanza.

Belemnites ("carbonds"). Oysters near by.
trapper's creek, { 3 or 4 mi. S. E. of Shell.
Recent shells + recent snails
Oil creek, above Anchor, 35 mi. W. of
Thermopole on E. B. + E.

Recent shells + Mt. Sharp forms abundant.

N. side Shell Creek Canyon ^{10 mi. N. E. of Shell} 7 mi. E. of Shell.

O. c. pygmaea abundant everywhere.

.. *y. extremata*

also White Creek canyon, 8 mi. E. of Shell,
in stump pine forest.

also Dry Creek, 2 1/2 mi. E. + 3 mi. N. of Shell,
no timber - a few bushes.

snails 4 or 5 mi. N. of Jones Ranch, near Shell.

Belemnites + other fossils + snails all
along base of foothills from Shell
to Hyattville, + Shell to Basin.

Bones - slope of highest badland hill visible
from Shell, 2 or 3 mi. S. W.

Hill 12 mi. E. + 1/2 mi. N. of Bonanza
on S. slope of hill.

also some mollusks.

N.W. of Worland, largest gulch seen
from town. From time badlands
proper were reached, fossil bones
& teeth in great variety on nearly
every badland dome.

Large bones 4 mi. W. & $\frac{1}{4}$ to 1 mi. S.

Colorado

Terry Duce-

Best Tepee buttes at Nepesta

A.H. Stockdale - Arrowhead workshop at forks
of b. handle creek, foot of divide, near
Canon City.

1 mi. W. of Canon City at mouth of gorge.
O. cooperi + *O. depressa*?

3 mi. below Salida - Cambrian beds for
 $1\frac{1}{2}$ to 2 mi.

at ^{old} smelter just below them are fossils
Canon City Ordovician 1 mi. W., through N. & S.
Rifle - ^{small} hill 5 mile from town - Miss. House Ledge
Mammal & fish remains plentiful
Echippus, *Lepisosteus*, etc.

Sulphur Springs, Dr. B. Howard, by letter, 1910
Reptile bones in limestone 6 mi. from town

1 mi. W. of Timnath, bet. Ft. Collins & Windsor
Mollusks abundant in shale on bank of
the Poudre, just before it crosses C. & S. Ry.

Bethel - *C. h. betheli* at Red cliff?

Expense account Recd. May 21. \$350.00
 " 29 - 50.00
 June 21 - 400.00
 225.00

1917.

May -	Auto for May - W. S. Withers	58.00
" 10	White Davis 3 gal. drill	.45
" "	St. James & Frisk Som. bird permit.	.50
" 19	F. C. Moys - sash cord	.50
" 29	Greenman stores Co. - eyelets	.50
" 22	Wilson How. Co. bags & fire rack	3.50
" "	streamer's drug store carb. dialph.	.50
" 28	Co. clerk, auto fee	2.50
" 31	Nat. St. Bch. trav. check fee	1.50
" "	F. L. Royce Ganchet, paup, etc.	1.35
June 1	John A. Hall, auto Ins.	11.25
May	auto for June \$50.00	50.00
"	Withers extras	70.15
June 11.	Boston Cash Grocery - sugar	.10
" "	The Basket Groceries	2.85
" "	F. B. Wolf - meat	1.15
" "	Moys sash cord	1.25
" "	Miss Perkins eggs	.35
" 12.	Fet. balms - 2 dinners	.95
" "	" groceries	.55
" "	" 4 gal gasoline	1.10
" 14	" 2 dinners	.70
" "	" 4 gal. gas.	1.12
" 15.	Lowland - 2 dinners	.70
		203.50

Boulder, Colo.

June 12, 1917.

Norman E. Hinds and I started at 8:35 in Ford auto. speedometer registered 167 miles. Dined at Ft. Collins at noon, started on at 12:35. Pitched our tent near a spring S.E. of Round Butte at 3 p. m. Dial registers now 246 miles = 79 miles travel today. Cold, raw northwest wind.

On road N. of Wellington saw Arkansas? flycatchers 2 (the one without white tail feathers), Lark buntings common, shore larks, Redwings. Killdeers abundant at lake S. of Round Butte.

Collected fossils in Hygiene s.s. S. of the butte for 1 1/2 hours. S.s. is there almost vertical.

Planorbis & Physa - dead shells (fresh) abundant on shore of lake S.E. of Round Butte.

Cliff swallows abundant.

Night hawks common.

Round Butte, June 13, 1917

Thin film of ice on spring this morning. Bright, cloudless, cool morning.

Collected fossils on Hygiene s. s.

At least four well defined hard, iron stained zones, weathering irregularly into concretions. Dip 72° easterly, strike N. 32° E. The same dips extend into the butte, the highly fossiliferous horizon passing through the ~~sand~~ basal slope to the east of the butte, the lower Hygiene sandstone members passing into the top of the butte.

The butte is capped by a rather fine conglomerate several feet in thickness, ^{which} contains fossil wood. It is horizontal and caps other buttes and mesas, apparently. Probably Eocene. It appears to be lower than the Brule clay to the north.

Round Butte, June 14, 1917.

Collected at bluff N. of E. from the butte. The slope of the mesa is massive Fox Hills s. s., containing large iron stained concretions.

The bluff is capped by conglomerate, the lower part like that on Round Butte, upper part coarser and red, resembling the lower Fountain conglomerate, but containing much Dakota s. s., some boulders being 2 ft. in diameter. Found almost no fossil wood, but much Fountain limestone, and numbers of Mississippian cherts such as I found ^{resting} on granite ^{almost} due west of here on Boy Alder Creek, and in the Willap at Perry Park. Two contained brachiopods.

Saw one Mockingbird on mesa.

Wellington, Col. June 14, 1915

Left Round Butte at 1:35 p. m.

Collected in Pierre shales in
canal bank E. of high R. R. bridge
about 4 mi. N. of Wellington.
Dips 40 to 60° E.

Reached Ft. Collins at 6 p. m. &
dined there.

Camped W. of Trilby School House
on Fossil Ridge, about 7 mi. S. of
Ft. Collins.

Fossil Ridge, June 15:

Collected in L. C. Roseberry's
pasture S. of road, in Hygiene S. d.
Started out at 11 a. m.

Longmont, Col.

June 15, 1917.

Collected in Fox Hills sandstone
just below the old flour mill on N.

side of St. Vrain creek, about a mile below Longmont.

Throughout the trip the streams and lakes ~~and~~ were all high and I could find no mollusks except at Round Butte.

Reached Boulder at 5 p. m.

On this trip the dial shows 178.5 miles. We started with 10 gal. gasoline, bought 4 gal. twice, making 8 gal., returned with 6 gal., thus using 12 gal. on trip, partly over bad roads with many long, steep hills; = 15 miles per gallon.

Expense account.

June 19, 1917.	H. S. Coulson, devel. photos	.85
" 21 "	noys - sack cord ^{.90}	1.05
" 22 "	Flashlights - 2 -	2.25
" 23 "	noys - double boiler	.80
" "	H. B. Wolf - meat	2.95
" 25 "	Howard Grocery	4.25
" "	Withers, gasoline, etc.	5.36
" "	" " Pd. on auto	160.00
" 26	Salida 4 gal gas. @ .26 [¢]	1.04
" 27.	Screw driver + oil cups Bob. Spr.	.40
" "	1 lb. grease in differential	.35
" "	Pueblo 6 gal. oil @ 25 [¢]	1.50
" 28	Boone, Bob. provisions	.65
" "	" " dinner for 2	.70
" 29,	Pueblo, 3 gal gas. @ .29 [¢] 2 gal oil @ .50	1.28
" "	banocity syrup.	.60
" "	" doughnuts	.16
" 30	" 4 gal gas. @ .28 [¢]	1.12
" "	" pie	.15
" "	" groceries - receipted bill lost.	1.75
July 2	Salida - groceries	.70
" "	" meat + eggs.	1.30
" "	" Bakery goods	.35
" "	" 2 yds. canvas	.56

Pueblo District.

Baculite Mesa - 8 mi. N.E. of Pueblo.

Tepee Butte E. of Limon 12 mi. N. of Pueblo
also S. of Mesa.

~~Pueblo to~~

Pueblo to Canon City.

Sakata s.s.

Graveros shale.

200 ft. thick, bluish gray.

Fossils in calc. s.s. 50 ft. below top and in
concretions 30 ft. above base.

Graduates above into

Greenhorn limestone - 55 to 50 ft.

l.s. layers alternate with shale.

Inoceramus labiatus

Carlike shale - 180-210 ft.

Argillaceous shale.

Niobrara, 600-700 ft. Shale-l.s. at top & bottom

sandy shale at bottom 1-2 ft. - shark teeth &
other fish teeth & pebbles.

above this 50 ft. l.s. - *Inoceramus defossus*

Piasek - 2200 ft. - Barren zone, lower 400-500 ft.

Purity zone, next 600 ft.

Baculite zone, " 100-200 ft.

Tepee Butte, " 1000 "

Boulder, Colo., Tuesday,

June 26, 1917.

Started with Philip Andrews in Ford auto with camp outfit at 10:17 a.m.

Gasoline $7\frac{2}{3}$ gal.

Reason dial at 413 mi. Trip dial neutral.

Reached Denver at 12:10.

Lunched on Federal Blvd. just beyond Denver.

Bought 4 gal. gasoline at Sedalia

Camped about 5 or 6 mi. S. of Monument at 5 p.m.

Cloudy morning. ~~Too~~ Hot early in afternoon. Rained at 4 p.m. and again at ~~4~~ 6:30 p.m.

Colorado Springs, Wednesday

June 27, 1917

Left camp at 8:45; 15 mi. to Colo. Spr. Here we got repairs, etc. Tried to find Mrs. Harrison without success. Then started on south

Tepal Buttes first seen E. + N. E. from
railroad station at Butte. Very small
ones 47 mi. N. of Pueblo, W. of R. R.
We collected a few here.

Fossil Sta. 1 - above.

Pueblo, Colo., Wednesday,
June 27, 1917.

Passed through here at noon.

Took 6 gal. gasoline at 25¢

2:30, just after leaving Pueblo, going
down river, rained hard.

Morning was bright + delightful.

Mollusk Sta. 135, 6 mi. E. of Pueblo,
found beside "Santa Fe Trail."

Physa sp.

Found a leech 11 mi. E. of Pueblo.

Moll. Sta. 136, *Physa* sp., E. of

~~Avondale~~ Avondale, about 15 mi. E. of Pueblo,
in slough beside "Santa Fe Trail."

Also one mosquito and a lot of *C. rustica*

Camped a mile or two E. of Avondale
just E. of Sta. 136.

and Boone,
Awoodale, Cal., Thursday,
June 28, 1917.

Bright morning.

Sta. 137, slough north of camp in
river bottom. Physa sp.

Started out at 8:30 a. m.

Sta. 138. Sitch at Boone, north side
of River. Physa, Lymnaea, Planorbis
and Kraggites.

Maggies, Redwings, yellow headed blackbird,
yellow throats, nighthawk, bobwhites all
common.

2 Lewis woodpeckers at Boone.

Calif. or Gambel's quail nesting ⁱⁿ under rock
on dry tepee butte N. E. of Butte.

Mourning doves nesting.

Got provisions and dinner at Boone.

~~Worked on tepee~~

Geol. Sta. 2. Tepee Buttes N. E. of Boone.

Baculites, Trochammina, Lucina, Scaphites,
Heteroceras, Ptychoceras + gastropods.

Camped at buttes, Sta. 2.

Clear, hot day.

Boone, Colo., Friday,
July 29, 1917.

Drove up the hill above camp,
where we found a friable conglom-
erate, probably Pleistocene, resting
on Pierre shale. Dip of shale 92
S. \bullet 33° E.

Started up river on N. side at 8:30.

~~Got~~ Reached at 10 a.m.

Got 3 gal. gasoline @ 29¢ + 1/2 gal oil @ 5-~~8~~

Lunched at noon 25-mi. N. W. of
Pueblo on canyon city road. Here
Pinon-cedar loose forest on Niobrara
shales.

Passed through canyon city and camped
6 mi. N. near Garden Park.

Garden Park, Colo., Saturday
June 30, 1917

Two pairs of Bullock's orioles nesting
in broadleaved cottonwood over our tent.
A bush or low tree, deeply trilobed,

leaves, 8-15 ft high, abundant, very strong
skunk-like odor. - not *Rhus trilobata*.

The "~~candle~~" candelabra(?) cactus
we first saw north of Buttes, and scatter-
ing as far east as we went (~~Butte~~ Boon)
are here abundant, in dense thickets,
4-6 ft. high.

Russian thistle abundant.

Mosquitoes rare

Gnats terribly abundant

Bicade abundant.

~~See~~ Western yellowthroat,

Woppie common

Mourning Dove "

In a slick bluff just above
camp the thin limestone band containing
red jasper? fragments occurs midway
in the light gray series (100 ft. or more)
of shale, l. s. & s.s., but no fossils
found. This horizon is friable
& so not usually exposed.

Salida, Colo., Saturday
June 30, 1917.

Left Cañon City at about 9:30 a.m. Pretty good road most of way. about ~~10~~ 15 miles, I believe, over the mesas, then into the Arkansas canyon for remaining 40 miles.

Took 4 gal. gasoline at Cañon city. Sta. 139, Physa, slough cut off by wagon road grade in Arkansas river canyon, about 20 mi. by road ^{up} from Cañon city. No adults found.

Camped in Municipal camping ground near Salida (S. W.) at 3:30 p.m.
W. wind

Salida, Colo., Sunday
July 1, 1917.

Cool east wind. B.b. cloudy, soon clearing.

Phillip caught 2 speckled trout (with red spots) last evening and three early this morning, in the creek.

Bathed & washed clothes in morning.

Bullock's oriole singing in cottonwoods
at camp.

Sta. 140, narrow leafed cottonwoods
and willows S. of S. Arkansas river, ~~N. of~~
due S. of this camp, near race track

Valonia (42 under one 4-ft. stick),
Agrionax (common in river bottom on N.
side of river), Pyramidula, Zocitoides,
Vitina, Pupilla, Encosinus.

Salida, Colo. Monday,

July 2, 1917

Bright morning. Drove up into Poucha
creek canyon and camped.

Sta. 141, ditch by Poucha roadside,
3 mi. S. W. of Salida, Colo.

Physa sp., Planorbis, Lymnaea, Pisidium
I put some Pisidium into the anatomy
bottle (alcoholic) for Sterki. ~~Physa & Lymnaea~~
all immature.

Sta. 142 - long-leafed cottonwood grove,
just above camp, within mouth of
Poucha creek canyon.

Pupilla blandi, *Thysanophora ingerelli*,
Vitrina alaskana, *Zonitoides arborea*, *Valonia*
cyclophorella. Not good snail locality.

Two yellowthroats have been singing
about camp persistently, responsively.
First one sings the strong, complete
song in one group of trees, then the
other in the other group of trees sings
a weaker, incomplete song, just as I
have ^{often} heard the female house ^{finch} respond
to the male. Have seen neither, so
do not know whether one is a female.

Query: Why are all the Physas and
Lymnaea at Sta. 141 immature? Perhaps
the Physa is an annum. Is the *Lymnaea*
also?

No mosquitoes at this camp or the
last one, but abundant across the stream
from last one, at Sta. 140, where we collected
adults. Have seen no larvae yet on the
trip.

Expense account

July 3,	Palish Buena Vista, steak		.50
" "	" "	roughnuts 20 pie ¹⁵	.35
" "	" "	6 gal. gas. @ 31¢	1.85
" 3-	Buena Vista, steak		.50
" 5-	" "	postage on parcels	.10
" "	" "	pie	.15
" "	" "	provisions	1.00
" 6	Leadville, 5 gal. gas. @ 32¢		1.60
" "	" "	ham ⁴⁰ - tenderloin steak 40¢	1.80
" "	" "	butter 45¢, berries 20¢, oranges 50¢	1.15
" 7	" "	bread ¹⁰ rolls ¹⁵ milk 45¢ (3 @ 15¢)	.70
" "	" "	porch	.30
" 9	" "	gas, 3 gal @ 32¢	.95
" "	" "	sev. pictures	1.30
" "	" "	provisions	1.25
" 11	Red Bluff	"	2.60
" "	" "	"	.80
" 13	" "	"	.85
" "	" "	"	1.75
" "	" "	Minturn	.50
" "	" "	"	.60
" 15	" "	"	.70
" 17	Byssun hauling load over pass		5.00

"	18	bottomwood hauling onto 1 st 2 1/2 gal gasoline @ .90	2.40
"	"	Glenwood spr. 6 gal. gas @ 33 = \$1.98 bolt 5¢	2.03
"	"	Glenwood spr. provisions	3.10
"	20	Basalt provisions 12 ^{lb} x .65 = .78	1.90
"	"	aspen " 50¢ x 1.15 = .575	1.65
"	21	" sugar	.25
"	"	" file	.40
"	"	" nails & coles = snail brushes	.50
"	23	" mentholatum	.50
"	"	" 1/2 Ham @ .25 = .125	1.25
"	"	" provisions	2.55
"	24	" 6 gal. gas @ 36¢	2.15
"	"	Glenwood spr. 2 dinners	1.10
"	"	" provisions	.85
"	"	" dev. photos	1.43
"	26	Rifle 6 gal. gas @ 32¢	1.92
"	"	Glenwood spr. provisions	2.15
"	"	" milk	.60
"	"	Carbondale, 3 gal. gas @ .34	1.00
"	30	Glenwood spr. dinner for 2	.90
"	"	" provisions 3 ^{lb} x .15 = .45	3.40
"	"	" "	1.25
"	"	" dev. photos	1.30
"	31	" dinner for 2	.70
"	"	" meat	.40

Buena Vista, Colo., Tuesday

July 3, 1917.

Came here today. Road fair. Bright most of day. Ran through town and into ~~north branch~~ of south bottomwood canyon.

Sta. 143, poolby roadside in depression made by scraping earth for grading road. *Lymnaea palustris* (?) abundant, no adults found. Planorbis parvus?

Sta. 144, roadside pool in west edge of Buena Vista. *Lymnaea palustris* and *Pisidium* (same as at Salida) both abundant. No adult *Lymnaeas* found.

Buena Vista, Colo., Wednesday

July 4, 1917

Bright, cool morning soon warming. Sta. 145; ivy + climatic covered rocks at foot of big granite rock slide, just across road from camp.

in S. Cottonwood canyon.

Orchelimum cf. *depressa* common.
No lime embryos found. A few dead
Vitrima and *Zonitoides*

Sta. 146, aspen grove half mile or
more above 145; just below fork
of stream. *Pupilla*, *Valonia*, *Zonitoides*,
Vitrima and *Pyramidula* s. *cooperelli*;

Thursday

Twin Lakes, Colo., July 5, 1917.

Came here this forenoon. No collecting
on the way. Mountains barren, aspens
mostly young growth on burned ground.

Sta. 147, aspens on slope and
in ravine just north of Twin Lakes
town, which is on north side at head
of upper lake.

Valonia, *Succinea*, *Zonitoides*, *Pyramidula*,
Encyonema, *Pupilla*, *Vertigo*, *Vitrima*, *Pyramidula*
only on moist slope in ravine.

Twin Lakes, Col., Friday
July 6, 1917.

cloudy morning, calm, soon bright
and hot in sun.

Prairie dogs - seemingly the plains
species, common here, alt about 7000 ft.
Lakes very barren, little life + timber
sparse near shore, aspens on slopes
mostly small.

saw a sucker at head of lake
Sta. 148, ~~both~~ under willow in
bottomlands at head of upper lake.

Pyramidula, Vallonia, Agriolimax, Eucorulus
Sta. 149, small brooks entering upper lake.
Planorbis, Bryozoa, Pseudium.

Sta. 150, small stream about ~~near~~^{eight}
miles (by wagon road) N. W. of lower
Twin Lake, near Hayden ranch.

Bryozoa cf. Techella, Pseudium sp.
Reached Leadville about 1:30.

Then ran back to the junction,
crossed the valley, and camped near
the fish hatchery in edge of lodge
pole pine grove. No quibex

abundant. Lots of water in the broad valleys on this side particularly mosquitoes abundant at Twin Lakes also.

Bought 5 gal. gasoline at 32¢ at Leadville.

Rained a little during afternoon

Leadville Jwa. Camp,

Saturday, July 7, 1917.

cloudy morning, sprinkling before noon.

I climbed over the ridges for about two or three miles back of the fishery near camp. Everywhere on slopes are more or less open forest of lodge pole pines up to 6 inches in diameter, all new growth over a region from which the timber had all been cut years ago. A few ~~of~~ aspens scattered through, but no ~~open~~ aspen groves and very little undergrowth. Few rock exposures and no rock slides. Not a land snail. The bottoms of the ravines carry water and are

soggy, covered with willows where not
~~too~~ narrow. No land snails there
either. A few immature *Lymnaea*
in very small rivulet at fish hatchery.

The main valley here must be
more than a mile wide, mostly
marsh, with thicket of willows.

Sta. 15-1, Willow thicket along river
bank on upper road from fish hatchery
to town.

Succinea avara, *Encornulus*, *Pyramidula*,
Vitrina, *Popilla*, *Agriolimax* - all but *Pyrami-*
dula scarce.

Sta. 15-2 Small stream ^{where road west of} at fish
hatchery. ^{turns to Leadville - a mile W. of hatchery} *Lymnaea* - no adults found.

Rained at intervals during late
forenoon and afternoon, until nearly
bedtime.

Leadville, Colo., Sunday,
July 8, 1917.

Bright morning, warm in sun,
cool in shade. Took bath and washed

clothes in morning.

Sta. 15-3, willows and aspens back
of fish hatchery, not in bottomlands
Vitruina and *P. pyramidalis*

East Fork of
~~Left~~ Eagle River Camp.
Monday, July 9, 1918.

Bright morning. Left camp near
fish hatchery at 9:30, went to Leadville,
left there at 10:30. Passed over Tennessee
in a driving rain just before noon.

Just after starting down west slope
we searched aspens on slope S. of creek
for snails, but found none. Grove was
open, aspens were all very young, very
few leaves and all sticks and logs were
dry, rotten, charred lodge pole pines.

We followed the ~~small creek~~ ^{west fork Eagle River} ~~down~~
to ~~where~~ ^{where it} ~~sloped~~ ^{crossed} ~~the~~ ^{the east fork of} Eagle River
Valley where the road runs up into
the ^{colony} valley to an old saw mill before
crossing. We camped just below the
sawmill.

Sta. 15-4, under rotten, charred,

large pole pine logs and sticks on open, wet ground - no trees at all now - right around the tent.

Eucumbus abundant, *Agriolimax* common, *Succinea* common, *Vitrea* not very common, *Pupilla* and *Vertigo* scarce.

Mosquitoes very abundant here.

Sta. 155; Porphyry rock slides edged by aspens, gooseberry, elderberry, etc. N.E. of camp. *Orchelimum* cf. ^{dark form} *cooperi*, scarce, very few found alive, mostly immature.

The porphyry appears to be intruded into sandstones.

Rained in afternoon again.

{ 4 mi. above Pando,
East Fork Eagle River, Col.

Tuesday, July 10, 1917.

Bright morning, cloudy at noon.

collected at Sta 155 (see above), from several different rock slides. As they are all the same form (apparently a form of *Orchelimum* *O. h. bathyaltu*) we put them together under one number.

Sta. 15-6, Alder grove in slight, steep
ravine just S. of where the road crosses
the stream. Only found *Pupillidae* - *Vertigis* or
Bipidaria - common; and one *Vitrina*

Found here also red columbines.

Phillip searched the water of the stream
for *Pisidium* and other aquatic mollusks,
without success.

Sprinkled at intervals during afternoon.
bleamed the few live *Oreohelix* from
Sta. 15-5 in camp and saved the anatomy
of all except the smallest.
alt. 9100 ft.

Pando, Colo., Wednesday,
July 11, 1917.

Partly cloudy morning.

Left last camp at 9:30 a.m.

Sta. 15-7. Quartzite slide, very dry, ^{cast} ~~with~~
side of river 2 mi. above Pando. Three dead
Oreohelix, like those at Sta. 15-6. ^{dark form of} ~~cooperi~~

Sta. 15-8, Guisno side near ice house
about half ~~mi~~ ^{mi} N of 15-7. *Oreohelix*, live
ones scarce, same form as at 15-6.

Sta. 15-9, similar slides across river

directly opposite 15-8, same species
of *Oreohelix*; also *Lomatidex*.

Sta. 160. Ice ~~pond~~ pond between 15-8
and 15-9. *Lymnaea* sp. *palustris*.

cleaned all live *Oreohelix* from 15-8
and 15-9 and saved anatomy of ~~all~~ all the
larger ones, none adult.

also cleaned *Lymnaea*.

No rain today - sprinkled a little.
Moved camp in afternoon.

Red Bluff, Colo., Thursday

July 12, 1917

We are camped ~~probably~~ three five
miles above Red Bluff, in a lateral
valley near the ~~to~~ canon.

Bright morning, cold before sunrise,
soon getting hot. altitude 8850 ft.

Sta. 161, quartzite slide fringed by
aspens, ~~W.~~ side of valley, $\frac{1}{4}$ mi. N. of Holy
Cross Forest ranger cabin, N.E. of camp.

Oreohelix, weathered bones scarce, no live
ones found. In the aspens we found

Encrinurus, Vestigo or Bijidaria, Pupilla, Vallonia, Thyrsanophora, Vallonia zouboides

Sta. 162, quartzite slides fringed by elderberry and *Lonicera*, on S. side of valley opposite Sta. 161. A number of live *Cerobelix*, same sp. as 161, probably *C. cooperi*, also *Vitruvia*, *vallonia*, *Lonicoides*, *Thyrsanophora*, etc.

Sta. 163, creek at camp. In an hour's work we obtained only 4 specimens of *Pisidium*. Stream very small and probably mostly dry except perhaps deeper holes in dry season.

An almost clear day, hot in middle of day, cool in morning and evening.

Minturn, bob, Friday
July 13, 1917.

Bright, clear morning.

Left camp above Red bluff at 9: a.m.

Very long steep hill after leaving Red bluff.

Sta. 164. Steep south facing slope about 2 miles S. of Minturn, among Balsamo. ^{before the road came down to the top of the hill}

rhiza leaves leaves. Probably cf. *cooperi*,
found fairly common alive, bones abundant.
The slope had been burned over some
years ago. Sage brush all dead, cherry
started from the roots, erosion rapid
since fire in steeper places. ^{h. slope}

Sta. 165, foot of limestone cliff where
road over hill from Red bluff to Minturn
comes down to river, under various shrubs,
herbs and grass, about 3 mi. above Minturn

This hill is much the worst we have
crossed. We were stalled several times and
had to stop to cool the engine and down
grade to cool the brake.

Proceeded to within 2 miles of Minturn
and camped there, at mouth of Cross Creek.

Prepared ^{live} *Oreobolus* from Sta. 165
to mail to Pilsbry and to Mrs.
Thompson, also some to send to Mr.
Hubbard for the anatomy.

Cross Creek comes from the direction
of the Mt. of the Holy Cross, whence it
probably derives its name.

Rained in late afternoon.

Monte Vista, Colo., Saturday,
July 14, 1917.

Bright morning.

I went up river a mile crossed on bridge and back on east side to where brook + deep, untravelled gulch comes in from the east, to

Sta. 166, aspen grove on steep slope, no rock exposures near, but fragments of coarse sandstone from a few inches to a foot in diameter scattered in the surface of the loamy soil. Small species of snails - *Valvonia*, etc., under sticks, *Oreohelix cooperi* common and very active under tangle of low leguminous plants on aspen slope, mostly adult. At Sta. 167 and 165 they ~~was~~ were mostly immature; at 166 the vegetation was wet from the heavy dew and yesterday afternoon's rain, north-facing slope. Only about a mile from Sta. 165.

Bright all day

Cleaned snails in afternoon.

Two embryos in one *Oreohelix* from Sta.

165, but they were lost in drying - the first we have seen within the parents this season.

Miiturn, Colo., Sunday,
July 15, 1917.

Bright, hot forenoon.

Stayed in camp, bathed, shaved, washed clothes & puttered around.

Phillips collected at the following Stations:

Sta. 167, about a mile up cross creek, on E. side, in s.s. slide at foot of cliff. *Orekelix cooperi*, a few aliae.

Sta. 168, $\frac{1}{4}$ mi. below 167, aspen grove. *Laciniodes*, *Thysanophora*, *Pupilla*, *Encoumus*, etc. *agriolimax*, etc.

Sta. 169, $\frac{1}{4}$ mi. up cross creek, on E. side, small slough. *Physa* sp. and *Pisidium* sp., *Succinea* sp. (dead), *apexa*.

Both mornings ~~both~~ cross creek water has been six inches ^{higher than} in the

evening, so it must take about 12 hours for the water from the day's melting to reach here.

Minutun, Col., Monday,
July 16, 1917

Bright morning. Broke camp at 8:30, & left for Glenwood Springs.

Sta. 170, perhaps a mile below our camp, ~~at~~ in shrubbery at foot of limestone ledge by roadside, a short distance (4/5 mi. perhaps) above the bridge ^{half mile} above Minutun.

O. cooperi plentiful alive. No ^{open} slide

Sta. 171, in dandelion tangle amid cherry, amelauchia, etc. on slope below l. s. ledge at Minutun. *O. cooperi* abundant.

Sta. 172, under *Fraxus speciosa* in aspen grove on slope on S. side of river, about 6 mi. below Minutun, l. s. showing far up the slope. *O. cooperi* abundant, large, a few *Zonitoides* & *Valonia*.

Sta. 173, slough at mouth of creek coming in from the S., 11 mi. by road

below Minturn, 6 mi. above Wolcott,
as shown by speedometer. *Pisidium*,
small, abundant about water cress.

At Wolcott the Dakota & Kansan
formations well exposed, with red
beds 2 or 3 miles above.

Sta. 174, ~~the~~ ^{is}

The road down canyon from
Gypsum was closed for repairs, so
we turned south thence S.W. & took
road over Cottonwood Pass.

Sta. 174, north facing slope, under
oaks, gypsum soil, near top of ^{pass} pass.

Fine *O. depressa* common, boxes abundant

Sta 172 is quite likely beneath gypsum
instead of l. s., as gypsum appears a
little way down river with slip that
would carry it over this station.

An immense body of gypsum of
great thickness extends from two or
three miles above Wolcott interruptedly
to far below Gypsum and several
miles southward along the route we
took, sometimes bright red, usually

light gray. It underlies typical Red Beds like the Lykins formation. What looks like Hermosa ls. s. shale & s. s. immediately underlies the gypsum - that is like the barh at Disappointment Creek and the head of Gypsum creek, S. of Paradox Valley.

^{bottomwood} We had trouble getting over the pass into the next creek west of the one that flows through Gypsum, and stalled completely on hill up the creek, could not even start engine on steep grade, had to back down to start. Only 2 gal. gas. & 22 mi. from Glenwood. So we camped on the creek as it was 5:30 p. m. Bright & hot day.

Tuesday, July 17, 1917.

bottomwood creek S. W. of Gypsum, 60 ft. Right much warmer than up river. Sta. 175, under oaks on a ^{steep} gypsum slope at camp. *O. depressa*, small, numerous. The bones of an evergreen on the gypsum slopes. There are bones of *O. cooperi* all along the road yesterday.

day, most of the way from Minutemen
to this camp, whatever the road
ran at base of brush covered slope
on S. side of river.

Broke camp at 9 a. m., and stalled
on the first steep rise.

Best *Oreohelix* collecting ^{on slopes} seems to be
at base of lower fringe of shrubbery
usually in this region.

a big auto and man from a second
one helped us up the bad hill where
we first stalled. Then we ran for two
or three miles and stalled on a long,
steep, rough hill. Gasoline so low (1 1/2 gal.) it
would not feed the engine on steep grade.
While Phillip went back to the ranch
for a team I collected in the aspen
groves about the auto,

Sta. 176. aspens on rather steep
slopes rather dry situation. *Vallonia*,
Pispeila and *Vitrina* - none of them
abundant. Numbers of ^{young} *Oreohelix* shells,
none anywhere near adult - largest not
more than half grown. Bones all above

this canyon along roadside.

Got man and team to take us to what he called the top of Cottonwood Pass, then we started on, crossed a creek and stalled again in pulling out of its valley, when near the top, as it was then 5 p.m. we made dry camp there.

Sta. 197, Stagnant pond about half mile W. of top of Cottonwood Pass.

Lynceus pedestris and *Planorbis trivolvis* abundant.

crossed another creek and stalled in pulling out of valley. Too steep for gasoline to feed engine. ~~tramped~~ humped a mile from water. Had a little small aspen wood to burn. Rained hard just after we got tent up.

Camp W. of Cottonwood Pass,

Wednesday, July 18, 1917

Worked for some time trying to get machine up road without load. Then Phillip went ahead a couple of miles and got a team + 2 1/2 gal gasoline. We crossed to cattle break + down the creek to some

vesicular basalt slides, where we
lunched at

Sta. 178, N. side Battle Creek in
basalt slides. *Oreohelix depressa*, large
bivalves common, only found one dead
live exampl. Some dead shells contained
old embryos. Also found *Coelocapsa*
lubrica, *Zonitoides* & *Vitina*

Reached Glenwood Springs at 2:30
p.m., got provisions, then started for
Aspen, camped at bridge above
Carbondale about 3 or 4 mi.

Bright & hot most of day.

Sta. 178 is perhaps 4 or 5 mi. up
Battle Creek canyon above where the
gypsum begins. The latter continues
down Roaring Fork nearly to Glenwood,
and up many miles above Carbon-
dale.

above Carbondale, Thursday
July 19, 1917.

Bright, very hot morning. Broad
river bottom with narrow leaved cotton-

wood groves, Oaks, Mt. mahogany, cherry, rose, Amelanchier, etc on the slopes of gypsum capped with basalt.

Sta. 179, slope S. of river near bridge, gypsum, with basalt slides for up the slope coming from top. *O. depressa*, boxes all the way up, occasionally live examples, latter especially abundant under dense mat of *Clematis* by R. R. track at base of slope, below bridge, where they vary all along here greatly in height of spire and size. *Lonicera* plentiful, *Neloxia* common, some *Pupilla*, *Emmoeulus*, etc.

Hard rain in afternoon while we were cleaning snails, about 2 p. m.

after rain I went into woods just across road from camp & collected at

Sta. 180, rather open grove of narrow-leaved cottonwoods, with clumps of birches & willows, ~~at~~ N. of river & E. of road at bridge above Carbondale. *Creobelix cooperi* & perhaps *depressa*, very active & abundant, on ~~leaves~~ decaying leaves and decaying wood, many of them out in

the open. Found none at all on the green vegetation which formed the undergrowth. Under sticks and small logs found *Zonitoides* + *Syracoides*.

Never found such a fine colony of *Oreohelix cooperi* under shrubbery in bottomlands at Montrose, Colo., + under willows and roses ~~at~~ in bottomlands at Preston, Idaho. One pair found in copulation.

Aspen, Colo., Friday,
July 20, 1917.

Bright, hot morning.

Left camp for Aspen at 9 a. m.

Good road for a mountain road most of way, on ^{west} ~~the~~ ^{side} of river to within a mi. of Aspen

Sta. 181, stagnant pond one mile below Basalt. Two or three small *Lymnaea*s and a few *Physa*s ^(one pair in copulation) all very thin. Green grass snakes.

Sta. 182. Reached Aspen about noon, bought provisions and drove

out about 6 mi. W. on well travelled
road on S. side of river, to
Sta. 182, an aspen covered slope
of ^{of Mancos shale} just where the road after climbing a very
long hill, starts down into a valley.
Oreohelip very abundant, active, under
the aspens, on dead wood and rotten
leaves, none on green vegetation of the
wooded but open undergrowth. Miss.
Lillian Dyer Thompson writes that
the Oreohelip I sent her greedily ate
lettuce and cornmeal, also found
here Vitrina, Eucanulus, Vallonia, Papilla
Zonitoides and Pyrauidul(?)

Then drove back to the edge of town
and turned S. into the canyon of Castle
Creek, & camped just within the canyon,
a good camp ground. Mosquitoes not
plentiful; in fact, have not yet seen any here.
Rained all about but not on us in afternoon.

Aspen, Colo., Saturday

July 21, 1917

Bright, cool early morning, but hot as
soon as sun reached camp at 8 a. m.

Sta. 183, out. a mile or so W. of S. from town, alt. about 8,500 ft. I believe (look up *Aspen folio-topog.* sheet). Bleached shells of *O. cooperi* all the way from camp to top of mountain. Did not look so much for live ones on lower slope. Near top on N. side they were common and fairly active in aspens, but particularly plentiful along sharp ridge leading to top from the east, under *himmilinniv* and other undergrowth beneath small lodge pole pines, where the deciduous leaves and pine needles mingled - ^{and under} on decaying [&] leaves, including needles, more on green vegetation. In the aspens under sticks and logs ^{and red s. rocks} were found *O. cooperi* (mostly young), *Vitrina*, *Encourina*, *Zonitoides*, *Thysanophora*, *Pupilla* and *Radix* (*Vertigo*?). The aspens near top with very dense undergrowth did not seem favorable to snails.

W. side of creek here the ^{is} ~~lito~~ ^{is} all red s.s.; E. side it is granite. W. side of Maroon (next creek W.) red s.s. shows in great wall well up creek, with lighter colored

rock above, dipping at high angle down stream & to the N.W. - N.W. of these (W. of town) are mountains of Mancos shale. The isolated butte just below town, on S. side of river, is red s.s. Also the Mt. N. of river.

Sta. 184, granite slope E. of creek at camp. Very dry, shrubbery varied but stunted. Scattered bones of *O. cooperi* all way up & one or two live ones near top.

Clear and hot most of day but threatened rain for a while in afternoon and did rain on higher mountains.

Aspen, Colo., Sunday,

July 22, 1917.

Hot bright morning, cloudy afternoon, & cooler, sprinkling at times.

Phillip collected at Sta. 185, in ^{so. of creek below} bottomlands about camp, under narrow leaved cottonwoods, birches, alders, willows, etc. ^{evidently both locs?} *Agriolimax*, *Pupilla*, *Vertigo*, *Thysanophora*, *Vitrina*, *Fouquieria*, *Vallonia*, & *O. cf. depressa*.

Collected a few mosquitoes. Have seen very few here.

Sta. 186, base of slope in slide com-

posed of rather small fragments of granite, E. side of creek, N.E. of camp. *C. cf. depressa*, mostly small.

Aspen, Colo., Monday,
July 23, 1917.

Drove to a quiet stretch of the river a mile or two above town,

Sta. 187, *Pisidium* plentiful in fine mud and sand at edge of stream, near willow roots especially.

Next we drove up into the mouth of Maroon Creek Canyon, where red s.s. dips steeply down stream & to the N.W., overlaid by what I take to be the Morrison beds. Just below bridge, on E. side of creek,

Sta. 186, undergrowth in aspens on banks of creek. *Oriskany* plentiful, dormant, & clinging to green ^{live} stems of shrubs, but not eating the bark. *Eucnemis*, *Thysanophora*, *Levitarka*, *Vitrina*, *Pupilla*, *Vertigo*, etc. These aspens are ~~on~~ continuous with those east

word up the Mt. at Sta. 183.

Sta. 189, aspen slope beneath S. S. cliff W. side of creek opposite 188. *Oreohelix*, *Platylia*, also *Thyranophora*, *Vallonia*, *Pupilla*, *Fertus*, *Vallonia*, *Vitrea*.

Bright, warm morning. Cooler & cloudy in afternoon, rained in evening.

As the creek was muddy and rising rapidly all evening, we moved our tent, beds, cars and entire outfit to higher ground at 9:30 p.m.

Aspen, Colo., Tuesday,
July 24, 1917.

Bright morning.

Left Aspen at 8:45 p.m.

Sta. 190, a mile or two below Basalt, on steep slope of Mancos shale just above the road. Bleached shells of *O. depressa*. Slope faces south, very dry, scattered juniper, cedars & sagebrush. Erosion, probably started by the cutting of the road in the steep slope, is rapidly carrying away the soil and has destroyed

most of the vegetation, hence we found
no live snails. Very few "boxes" higher
on the slope among blocks of basalt.

Sta. 191, ^{small} stagnant pond S. of road,
about 7 mi. below Newcastle, *Lymnaea*
palustris ~~so~~ plentiful, immature.

We drove through to Rifle, then north
from Rifle about 3 or 4 mi. & camped.

Very hot afternoon until it clouded
up and sprinkled, remaining cloudy
until night.

Rifle, Col., Wednesday,
July 25, 1917.

Bright, hot day.

We drove up through Rifle Gap to
Newcastle thence down river to Rifle
and back to camp.

Sta. 192, N. slope of ^{the west end of} ~~the~~ Mancos shale
terrace about a mile E. of Rifle Gap, very
dry. *O. hendersoni* *abundant* under *Araliacae*,
Ut. mahogany & other very scant shrubbery
on steep slope, abundant, active, clinging.

to stems and roots chiefly. Very little leaf cover under the low, stunted shrubs. Habitat same as at type locality.

Sta. ~~192~~ 193 slope and vegetation same as at #192, 2 ~~mi.~~ mi. W. of type loc. of Okhavi, which is 2 1/2 mi. N.W. of Newcastle. Boxes of *O. okhavi* abundant. In a short search we found several alive.

Sta. 194, sloughs 1/2 to 1 mile above Rifle. *Lymnaea palustris*, *Physa* sp. and one *Ancistrina* sp. floating.

Rifle, Colo., Thursday,
July 26, 1919

Bright, hot morning.

Left Rifle camp at 9 a.m. 8:45 a.m.

Left Glenwood at 11:30, went through Carbondale and up Crystal River, camping at 3 p.m. just above Redstone.

Sta. 195, slough in Crystal River Valley 5 mi. above Carbondale. *Lymnaea palustris* abundant, juvenile. One *Physa* sp.

Cloudy afternoon, rained in evening.

Redstone, Colo., Friday,
July 27, 1917

Bright, warm morning.

Sta. 196, aspen grove at camp about a mile above Redstone, E. side of river. *Oreohelix cooperi* and *depressa* abundant beneath the low undergrowth, active, mostly clinging to dead wood and decaying leaves, a very few on live stems of *Pinus* near base of plants - none on green vegetation. Also found *Vitrina*, *Emarginata*, *Valonia*, *Zonitids*, *Pyramidula*, *Thysanophora*, *Pupilla* and *Vestigo*. Large and small adult *Oreohelix* were everywhere mingled interminably, as were also the elevated *cooperi* and the depressed forms that I take to be *depressa*. While in dry situations the average size was less, yet evidently environment is not the only factor affecting size. Large and small were found after within an inch of each other - likewise *depressa* and *cooperi*.

Altitude by aneroid 7000 ft.

Sta. 197, on W. side of river, above

Sta. 196, about $\frac{1}{4}$ to $\frac{1}{2}$ mi. distant, ^{conditions} similar.

The rocks on both sides of the river here consist of red sandstone and red conglomerate, well exposed in steep cliffs, forming a rather narrow canyon. Aspens abundant, mostly small. Narrow-leaved cottonwoods near streams.

Bright all day, with occasional flying clouds, hot in sun, cool in shade.

Redstone Colo., Saturday
July 28, 1917.

Rained last night, cloudy this morning. Returned to Sta. 196, and within 150 yds. of camp got a gadedized bag full of *Crebelius* before 9 a.m. - very active. Three reversed live specimens. Found a number feeding on green vegetation, particularly the broad radical leaves of *Fraseria speciosa*.

I started at 9 a.m. from camp for top of mountain opposite camp, S.W. of Redstone village, going up at northern end near old roundhouse. Rained before I reached

the top, Aneroid at camp 7150 at 9 a. m.;
9500 at top of Mt. when I reached it at
just noon; 7300 at camp when I returned.
Sta. 198, at 8500 ft., in under undergrowth
in aspens. *O. cooperi* plentiful, active.

Sta. 199, at 9200 ft., under Mt. maples,
cherry etc., *O. cooperi* + the depressed form.

Bones of *Oreohelix* all the way from the
base to the top of the Mt.

This mountain is chiefly of red sand-
stones and conglomerates, dipping steeply
to the westward, above which is the
Morrison formation, capped by the two
Dakota sandstones with the interme-
diate sandstone-shale series. To the
^{west} westward the Manassas shales are well
exposed.

Redstone, Colo., Sunday,
July 29, 1917.

Rained again last night. Cloudy this
morning. Rained at intervals from 10 a. m.
to noon. Bright afternoon.

Phillip walked to Marble and collected a few snails.

Sta. 200, $1\frac{1}{2}$ mi. above camp, east side of creek, ~~on~~ at base of s.s. cliff with some limestone fragments, in grass under rose bushes, *Louicera*, etc. *Oreohelix cooperi* and *depressa*, abundant.

Sta. 201, 5 mi. above camp, in aspen grove, ^{above} W. side of river. *O. cooperi*, not plentiful.

Sta. 202, 1 mi. above 201, W. side of river, rather open aspen grove, in grass and ^{leaves} about rocks.

Sta. 203, N. side of river at Marble, on Mancos shale cliff, among ^{tall} grass, aster, geranium, strawberry, etc., very little shrubby ~~or~~ and aspens, some fallen timber. *Oreohelix cooperi* plentiful. altitude 8000 ft.

Redstone, Colo., Monday,
July 30, 1917.

Rained most of the night. Cloudy morning.
Broke camp a mile above Redstone at
9 a.m. and started down Crystal River.

~~this number may not be in log~~

Sta. 204, 9 mi. below Redstone, under blunatic, maples, etc. at base of red sandstone cliff by roadside on W. side of river.

Began raining hard about 11 a.m. & continued until 1 p.m., then rained at intervals all afternoon and evening. We continued to Glenwood Springs in the mud - very slippery in places but we ran without chains. Dined at Glenwood, got provisions & returned up Roaring Fork to about two miles, where we pitched our tent at the west end of the bridge.

Sta. 205, shrubbery near camp, especially under and below the bridge. *Oreohelix* plentiful, many clinging to the red mud of the banks - active.

July 31. Sta. 206, top of Mt. above #130-1916, *O. betheli*. We found boxes of *betheli* all the way up from 150, and obtained a few alive at & near the top, slope is being rapidly denuded. [see below]

Raining until dark.

Glenwood Springs, Colo., Tuesday,
July 31, 1917.

Cloudy, soon clearing.

Went to sta. 206 (see above.)

Sta. 206 recorded above by mistake.

Sta. 134 (19016). Revisited this station.

Found *O. mita* abundant. A few boxes of *O. betheli* all the way up. Quite a number of reversed *O. mita*, dead & alive.

Sta. 207, nest ravine S. of 133. *O. mita* plentiful under shrubbery at base of steep slope on S. side.

Cleaned snails until 9:30 p.m. by candle light.

Bright all day, warm, not very hot.

Glenwood Spr., Colo., Wednesday,
July Aug. 1, 1917.

Bright, hot day.

Cleaned balance of snails. Broke camp and started at 11:30, driving in Glenwood Springs then starting up Grand River canyon.

Sta. 208, below l.s. cliff and talus under

Eleuthera and shrubbery. *O. batheli*; mostly the smooth form, and *O. cooperi*?

Continued up canyon 6 mi. further to where cowboys were working on the ~~state~~ road with steam shovel, where we had to wait until 4:30 p.m. to get through. Road very rough and narrow, with few turnouts for several miles above the shovel, which is just below the Shoshone power plant.

~~Eleven miles above~~

Sta. 209, ^{10th} 11 mi. above Glenwood Springs, under Eleuthera & shrubbery at foot of canyon wall by roadside. Bones of *O. depressa* abundant all along and for miles below probably same thing. We stopped just for a few moments and obtained a few ~~for~~ alive for the record.

Camped 1 1/2 mi. from Glenwood at 6 p.m.

Walcott, Colo., Thursday,
Aug. 2, 1917.

Bright day.

Broke camp at 9 a. m. & started for
Walcott.

Sta. 210, bayou completely cut off
from river, 5 mi. below Gypsum.
Lymnaea palustris abundant.

Below Gypsum strata dipping strongly
up stream, as follows.

Red beds at top.

Gray s. s.

Gypsum

Black & gray shale & l. s.

Below Walcott section as follows where
the river cuts an anticline

Lower Navajo

Sabote

Morrison

Red beds passing through pink to white
at top as in Lykins of Larimer Co.

Black & gray l. s., s. s. & shale.

Gypsum

camped about half mile below Walcott

on S. side of river.

At camp the Dakota s. s. forms the river canyon bluff on both sides.

Wolcott, Colo., Friday,
Aug. 3, 1917

Bright & cold at sunrise, soon warming.
While waiting for the trains from east and west, both late, we climbed the hill N. of town - Benton & Niobrara - lower ~~is~~ 200 ft. or so black shale, intercalated l. s. & s. s. above overlaid at crest of mesa by white Niobrara chalk or l. s. *Favosites* & *ostrea* fragments as usual.
Sta. 211, Benton (Lower Kansas) slope just N. of Wolcott, very dry, under lnt. mahogany, etc. *O. cooperi* - bones abundant a few true ones found under one or two bushes.

Hinds arrived at 10:15 a.m. and we at once broke camp and started for McCoy.
Climbed a bluff of the Pierre formation

5-26 mi. N. ^{W.} of Wolcott. Lower Pierre shale occupies the valley & valley walls, about 200 ft. up outcrop of ^{thin} irregular sandstone layers with intercalated shales for several a bench, with another above it. Only a few fragments of *Succinea* and *Baculites* obtained. Many of the s.s. layers contain numerous small concretions resembling *Brachiopod* & *Pelecypod*.

Road steep ^{up} half way to State Bridge, and steep down hill the last half. Very hilly from State Bridge to McBay.

Reached McBay at 3:30 p.m. and camped near the hotel.

Expense Account.

Aug. 1,	Stemwood Springs, dinner for two	.90
"	" " " 3 gal. gas. @ 33¢	.99
"	" " " Baked goods	.25
"	" " " Ham	1.50
"	" " " Groceries	2.90
" 2	Gypsum provisions	.45
" 3	Wolcott " "	1.40
"	" " " 4 gal. gas @ .35¢	1.40
"	" " " Express on test pipe	.43
"	" " " Phillips fare to Boulder	10.40
" 6	McKay, repairs to clutch	.25
" 7-14	provisions 16.22	} 21.62
	hauling fossils 1.00	
	9 gal gas @ 40¢ 4.40	
" 15	Hot Sulphur Springs, fruit	.25
" "	" " " { " 5 gal gas @ .35¢ = 1.75	} 2.40
	" " " { oil 50¢, grease 15¢	
" 16,	draw by bread toaster, bread	.15
"	" " Fraser, dinner for 2	1.00
"	" " " repairs to auto	4.75
"	" " " 2 gal gas @ 35¢	.70
"	" " " Dolaho Spr., supper for 2	.70
"	" " " 2 gal. gas. @ .30¢	.60

Exp. Philip Andrews 9 seats

2.44

" N.E. Hinds

15.83

McClay, Colo., Saturday,
Aug. 4, 1917.

bloody, rainy forenoon

Foss. Sta. 2, basal l.s. W. of creek,
just above camp. Dip W.

Foss. Sta. 3, about 50-75 ft. above #2.

Moll. Sta. 212, dry slopes of basal l.s. +
s.s. ~~at~~ ^{W.} of road, across creek from McClay
Hotel. Cooperia, dead shells abundant, a few
live ones found active about the roots of
small mountain mahogany - leaf cover very
scant.

A label of Moll. Sta. 207 was found today in
one of the cloth molusk bags. Hence the lot
may be without a label.

Clear and warm most of afternoon.

Mosquitoes not common here.

McClay is on rock creek, 1 mi. from Grand Ave.
alt. 6500 ft.; by R.R. Sta. 6910, 1 mi. N. of E.

McClay, Colo., Sunday,
Aug. 5, 1917.

Bright most of day, with floating
clouds, hot in sun, cool in shade
breezy.

Hinds went out and collected at stations 4, 5, 6.

Mcloy, Colo., Monday.

Aug. 6, 1917.

Partly cloudy, hot in sun.

Foss. Sta. 7 about a mile E. of Mcloy ^{P.O.},
nearly as far ^{south of} ~~from~~ Mcloy R. R. station.
Same station as my sta. of the year of the
Rabbit Ear survey. Got a large series of
Carboniferous fossils.

Well. Sta. 213. about cedars & sage
brush, Mt. slope a mile E. of Mcloy P.O.
Archely same form as at 212, dead
shells common; found no live ones but
did not search much.

Hinds collected at ^{Foss.} Sta. 8, another of my
former stations, above Sta. 7.

Mcloy, Colo., Tuesday.

Aug. 7, 1917.

Bright, hot forenoon.

We drove up Rock Creek about 3 or
4 miles.

Foss.

Sta. 9, where carb. l.s. ~~two~~ dips suddenly down to creek on W. side opposite big ranch. collected fossils.

Moll. Sta. 10, dead *Oreohelix* + *Succinea* on dry slope at Foss. Sta. 9.

Foss. Sta. 10, N. E. of 9, on S. W. slope of Basalt Mesa in forks of creek, where carb. crosses creek from 9.

Foss. Sta. 11, about $\frac{1}{4}$ mi. N. and 100 ft. below Sta. 10, in ^{calcareous} shale, *Brachiopoda*, corals, gastropods and *Fusulina* - latter abundant in a narrow l.s. band.

Moll. Sta. 214, S. E. side of basalt mesa, E. fork Rock creek, about 5 mi. N. of McBay, *O. cooperi*, dead shells collected by Hinde.

Sta. Moll. Sta. 215, creek bottom at Foss. Sta. 10, *Cyramidula*, *Louitoides*, oae *Vertigo*.

Mc Coy, Colo., Wednesday,
Aug. 8, 1917.

Another bright, hot day after a cold night.

Walked down creek on W. side. Sta. 12, ~~at~~ S. of road, S. W. of hotel, top of creek bluff. *F. mealia* l.s. in gray calcareous s.s. beneath red ash. Same horizon as Sta. 11, about 100 ft below # 2, which is evidently equal to # 10.

Sta. 13, $\frac{1}{4}$ to $\frac{1}{2}$ mi. S. of # 12, about 25-30 ft. higher. Narrow band containing *Productus*, *Marginifera*, etc. at # 11 a similar condition prevailed, *Productus*, etc., occurring up slope above *F. mealia*, but as it was all loose material on steep slope I could not differentiate the horizons and the material was all put together.

Sta. 14, 5 to 10 ft. above # 13, brown gray l.s., weathering to brown, with crinoids + corals.

McEoy, Col., Thursday
Aug. 9, 1917.

Cloudy forenoon, sprinkling early.
Wool. Sta. 216, very small ditch
3/4 mi. S. of hotel, E. of creek, ditch dry
except a pool a few feet long, a foot wide
and 2 inches deep. Water in ditch
yesterday. *Lymnaea palustris* very abun-
dant in water, not found in dry part
of ditch. This seems to be wet from
seepage from conglomerate, which forms
a spring just below the ditch line.

Foss. Sta. 17, E. side of creek, hill
1/4 mi. W. of Wool. Sta. 216. Grinnell
X.S.

McEoy, Col., Friday
Aug. 10, 1917.

Partly cloudy, sprinkling forenoon and
afternoon, rained hard at 3 p.m.

Foss. Sta. 18. I went to Hinds Station
E. of creek, N. of McEoy P.O., & collected
fossiliferous cherts on slope S. of ^{mine} tunnels.

Seem to be same as Milltop cherts from Perry Park, etc.

Foss. Sta. 19 same horizon as Sta. 17, crinoidal l.s., point half mile E. of McCoy P.O., N. of creek. I collected only one or two fragments of crinoid, but many other things. The red small cylinders in ^(spines?) masses were with the crinoid, but the *Productus* & *Fusulina* were from the slope below & probably from a little lower horizon. The l.s. was just ^{same} below a coarse red arkose, and ~~lower~~ ^{as} Sta. 2 horizon.

Coll. Sta. 217, *Succinea* sp. ^{grass,} on sticks and boards at edge of tiny rivulet from drip of small flume, 1/4 mi. N. of McCoy Hotel, E. side of creek, along bluff. Three *S. avara* close by under boards, not in sight on bank.

McCoy, Cal., Saturday,
Aug. 11, 1917.

cloudy most of day, but warmer
I returned to Sta. 19, collected a good

lot of *Fusulina* and *Bryozoa*, and traced it through to camp, proving that it is the same horizon as #2.

Also collected from the horizon of Sta. 3, just north of the road close to camp, and also a quarter to half mile N. of road, keeping the 2 lots separate. The other day we collected at both places and put all together, I believe.

McBoy, Colo., Sunday,
Aug. 12, 1917

Bright morning.

After washing breakfast dishes, before taking my bath, I revisited Sta. 217, collected more *Succinea* spp., and also *Pyramidula*, *Lomitoidea*, *Pupilla*, *Encumber*, *Vitrina*, and *Vallonia* and *Agricola* (not black, some dark brown, small). Found both species of *Succinea* under bottom of flume further up the slope; and *Lymnaea* in the flume - abundant - not mature,

seem more like *profima* than *paucistrius*;
common in ditches about Mc Coy.
Raining, cold afternoon.

Mc Coy, Col., Monday,
Aug. 13, 1917.

Still cloudy, raining, cool.

Drove to Egeria Park.

Roll. Sta. 218, alt. ^{8,200'} just after we
crossed top of pass & started down
into the Park, in aspen grove on
Dakota s.s. debris slope. A few
O. roehelii sp., *Pyramidula*, *Zonitoides*,
Pupilla, *Vertigo*, *Vitrina*, *Vallonia*.

The live *Vitrimas* all summer
have been less than half grown.

Sta. 219, aspen grove S. of road about
3 or 4 mi. E. of Toponas, Egeria Park,
just before road turns S.E. into a canyon
(road from the Park to Kremmling - old mail
road). *Zonitoides*, *Vallonia*, *Vitrina*, *Pupilla*, all
the live *Vitrimas* quite small.

Sta. 220, slope of lower Mancos

limestone shale N. of # 219, *O. cooperi* ~~numerous~~
plentiful dead, a few live ones under
small shrubs on very dry, badly
washed, west facing ^{N.W.} slope. This is con-
tinuous to the northward a few hundred
feet, to

Sta. 221, where the slope faces N.W.,
not so dry nor so badly washed. The
snails here are much larger, though
environment still unfavorable.

Sta. 222, Egeria creek, about a mile
or so S. of Toponas P.O., where it flows slug-
gishly through beautiful meanders. *Physa*
sp. common, not abundant.

Sta. 223, ^{about} 4 or 5 mi. N. of McCoy,
E. of road, beneath bluff of Morrison Lm
under Amelanchier, etc.

~~Some~~ ^{most} lot of embryos at # 221 had
just been expelled from the parent and
were clinging about the aperture of the
parental shell.

Nearly clear afternoon.

McBay, Col., Tuesday
Aug. 14, 1917.

Cloudy most of day, sprinkling at intervals, rained hard to the south.

Loaded snails & packed and shipped 9 boxes of fossils & box of snails.

McBay, Col., Wednesday
Aug. 15, 1917

Bright cool morning.

Left McBay at 8 a. m. Road to State Bridge very hilly. Bad hill just after leaving state bridge and another some miles up river, but made both with load without a stop. Were stalled several times between McBay & State Bridge.

Sta. 224, ~~where~~ where road passes over Niobrara beds about 10 mi above State Bridge. *D. depressa*, dead shells abundant on slope on l. s. where Amelanchier and Nit. In a boggy only vegetation and very scant, with leaves mostly washed from

Beneath, a very few found alive.

Sta. 225; Aspend at top of pass where road ^{passes over} Grand River to below Krennling back to Grand River above Krennling, probably 6 miles or so ^{about 5.} from Krennling. Pyramidula, Loricoides, Pupilla, Vertigo, Encornulus, Gallonia, Vitrea, etc. ~~to~~ damp ground, snails most common under the smaller sticks near edge.
alt. 7900 ft.

Sta. 226, slough by R.R. tracks about a mile up Grand River above Krennling. *Lymnaea palustris* abundant.

Sta. 227, puddle 3 x 6 ft. diameter, a few inches deep at bridge on road from Sulphur Springs to Granby, about 2 mi. above Sulphur Springs. *Lymnaea palustris* abundant.

Here we camped for the night.

Fine, bright day.

Road through ~~the~~ Gore's Canyon in part very bad, rough, steep, narrow and dangerous.

Granby, Colo., Thursday
Aug. 16, 1917.

cloudy morning, rainy afternoon
and evening.

Sta. 228, slough by roadside just
after crossing Grand River a mile or so
below Granby. Physa & a few Pseudis.

Sta. 229, Aspen grove by roadside
about 5 mi. above Granby, alt. 7900
ft.

Sta. 230, pond at Tabernash, Physa.

.. 231, ~~at~~

Lost 4 or 5 mi. before reaching
top of Berthoud Pass (alt. 11,500 ft.) is
rough, with many steep pitches.

Camped just below Idaho Springs.

Idaho Springs, Colo. Friday
Aug. 17, 1918.

Bright day. Reached Boulder at
1:30 p.m.

Sta. 231, Aspen grove, very dry, at

top of Floyd Hill 7.6 mi. S. E. of Idaho Springs, alt. 8,100 ft. ~~at~~

Road down east side from ~~at~~ Berthoud Pass steep, but smooth and hard. From Idaho Springs to Golden it is remarkably fine.

5 gal. gas. left in tank at Boulder.

Started with ~~77~~ 74 3/4 gal. gas. June 26, speedometer at 413, speedometer broke after leaving Wolcott at 140 E. Ran considerably over 200 mi. after that, making at least 1200 miles. Bought 76 1/2 gal. gas, making ^{about} 84 gal. Had 5 gal left. Hence used 80 gal. in 1200 miles, or 15 gal. per miles per gal. over mountain & plains roads. average price of gas 30¢

Extras taken & not used ~~\$11.75~~ \$95.15

Gasoline	25.20	24.00
Grease & oil		1.00
Repairs		6.15
License	2.50	}
Fuel	11.25	
Provisions, etc.		118.92
		<hr/> 149.07

Exp. of trip 63 days \$149.07 about \$2.50
per day, exclusive of cost of machine
and unused extras.

Expense of C. Wyoming trip, 1917.

Aug. 21	^{Boulder} repairs on tripod	.50
" 22	Boulder, specimen sacks	2.00
" "	" provisions 6 ⁹⁰ meat 1 ⁶⁰ -	8.50
" 23	Ft. Collins, dinner for 2	.70
" "	" 4 gal. gas. @ 25¢ 28¢	1.10
" "	" spark plug	.75
" "	Cheyenne, 2 gal. gas 26¢	.55
" 24	Wheatland, cookies 10¢ steak 55¢	.65
" "	" 4 gal. gas. @ 27¢	1.08
" 25	Douglas, provisions 1 ⁴⁵ meat 30¢	1.75
" "	" blanket pins 20¢ wire 60¢	.80
" 26	" 5 gal. gas. @ 28¢	1.40
" "	Glenrock, pie 20¢	.20
" "	" valve thread 10¢ casing cement ^{25¢}	.35
" "	Gasper, 4 gal. gas @ .27	1.10
" 27	Waltman, provisions	.60
" "	Lost Cabin, 5-7 gal. gas. @ 35¢	1.95
" "	" provisions 1.48, fan belt .75	1.23
" "	" bread	.35
" 29	Hyattville 5 gal. gas. @ 35¢	1.75
" "	" repairs (radiator hose & fan belt)	.75
" "	Basin - dinner for 2 ^{1.00} affidavit ^{50¢} telephone ^{1.20}	2.70
" "	" provisions	3.19

Aug. 29, Basin - repairs 1 tire ^{16.30} true rod ^{1.00}	}	19.05
oil 1/2 gal. ^{.50} cement ^{.25} air valve ^{.50} labor ^{.50}		
" 30 " Wheat feed ^{.20} apples ³⁰		.50
" 30 " Shell, 5 43/4 gal. gas. @ 35¢		1.65
Sept. 3, Grey Bull, fruit ^{.45} crackers ^{.15}		.60
" " Basin, 3 gal. gas. @ 30¢		.90
" " " provisions		1.63
" 4, Hogtown, 4 meals		2.50
" " " postage + ins. on 6 parcels		2.66
" " Howard, 6 gal. gas. @ 40¢		2.40
" " Last Cabin, 2 gal. gas. @ 35¢ =		.70
" " " sapphire oil		.15
" 5 Casper, 5 gal. gas. @ 27¢		1.35
" " " cantaloupes		.30
" 6 Wheatland inner tube \$3.90	}	5.30
" " 5 gal. gas. @ 27¢ 1.35		
" " " dinner for 2		.70
" " bheyenne, 6 gal. gas. @ 26¢		.56
" 8, Boulder, Auto 90.00 repairs		90.00
" " " repairs ^{14.29} gas 5 gal. @ 25¢ ^{1.40} grease ^{.25}		15.94
" 7 Ft. Collins, 4 gal. gas. ^{1.10} grease diff. ^{.25} oil ^{.25}		1.60
" " " dinner for 2 rect. lost.		.70

Boulder, Colo., Thursday,

Aug. 23, 1917

Bright morning, Edward S. Schwabe started with Edward Schawabe at 9 a.m. Gasoline $8\frac{3}{4}$ gal. Speedometer 1442 mi.

4 gal. gas. at Ft. Collins, 2 gal. at Cheyenne Speedometer at Cheyenne 1541.

Stopped at 4:30 at Lodgepole Creek, Speedometer 1554, where road crosses Ste. 232, reservoir just above road. *Lygus*, *Physa* and a couple of *Pisidium*.

Lodgepole Creek, 12 mi. N. of Cheyenne, Wyo.

Friday, Aug. 24, 1917.

Bright, cool morning, soon warming. Ste. 232. Went up creek a few rods above reservoir and got a few more *Pisidium*, *Lygus* & *Physa* abundant. There are 3 *Planorbis* sp. Under some shrubs I found 2 *Laccina*, some

Vallonia and one agriolimax.

Started at 9 a.m.

Horse Creek at 10:30 a.m. Speedometer 15-79, but had to double back 6 miles for Edwards' lost hat, so distance from Lodgepole is 13 mi.

Treeless & shrubless plain since leaving Bulger, except fringe of willows and a few cottonwoods along streams, but hills on both sides of Horse Creek are covered by small wt. mesquony, with a few shrub brush, etc.

Horse Creek is rather swift, with coarse gravel bottom, muddy water. Found no mollusks at all.

Sta. 233, Speedometer 15-89, perhaps S. fork Little Bear Creek. Pisidium (several), Lymnaea & small Physa, in spring brook by roadside just above ^{big} ranch.

Chugwater (1602) at 1:30 p.m. Got followed Chugwater creek for some distance and crossed some tributaries. Cottonwood & willows fringed the streams. Ranches few. No towns or stores between Cheyenne and Wheatland.

8-12-1917

214

215

~~216~~

~~drive up~~
Rock Creek



8460



except at Cheyenne, Wyo

Sta. 234. Wheatland, speedometer reads 1634,

Sta. 234, 6 mi. N.E. of Wheatland, speedometer 1640, small, shallow reservoir west of road. Ranunculus, Physa & Lymnaea, all dead. Water high. - perhaps live ones out further.

All the way so far, from Cheyenne, have passed exposures that look like Brule clay of N.E. Colo., and ~~are~~ for some distance before and after Wheatland (to ^{Laramie} North Platte) it was overlaid by what looks much like the Arikaree sandstone.

Camped at bridge over the Laramie river, speedometer 1643, elevation about 4400 ft. Cottonwoods & willows.

Had to ford two or three shallow streams today.

Camp is short distance below Wyo.

Uva, Wyo., Saturday,
Aug. 25, 1917.

Bright warm morning.

Sta. 235; river bottom at bridge below Uva, on Laramie river. Willows and cottonwoods, with dense undergrowth, below bridge. One dead *Oreohelix cooperi*, 2 live *Physas*, 1 live *Louiseioides*, several live *Vallovia*, dead *Planorbis*, *Lygumaea*, etc. Broken valves of one *Lumpischi ventricosa* (?) under the bridge.

Drove to Bokelder Creek 19 mi. W. of Douglas. Much of road very rough and hilly, and barren. For a few miles between the Laramie and North Platte there were pines on the rocky hills, mostly Tertiary, in one place limestone, apparently barriperous - no fossils.

Sta. 236, speedometer 1655, creek bottom, under willows and cottonwoods, *Louiseioides* and *Vallovia* alive, one dead *Vitrina*.

Douglas, speedometer 1703.

Station 237, speedometer 1708, 5 mi. N

of Douglas, a spring brook, *Physa*, *Lymnaea*,
one or 2 *Planorbis*.

Camp at Boyd's creek, 19 mi. W. of
Douglas, ~~with~~ willows and cottonwood
along bottomland, good water, altitude
5-100 ft.

Windy, hot afternoon

Boyd's Creek, Wyo., Sunday.

Bright, breezy morning. Aug. 26, 1914

Sta. 238, at camp. *Physa* in slough,
small ones in creek. One *Lymnaea*, one
Planorbis parvus & several *Anatya* in
creek, latter under rocks close to shore
in shallow water, none found in water
over 3 inches deep. In grove of narrow
leafed cottonwood one *Succinea*, *Vallonia*
and *Tonitoides*. Lost the *Lymnaea*.

Started at 10 a.m.

Had tire trouble, broke belt of fan
and had other trouble along the
road. Cold, strong, disagreeable
wind. Road better for some time after

leaving camp. Bad sand hills before reaching Powder River station.

at 6 p.m. camped a mile or two N. W. of Powder, on a sand ~~bank~~ ^{fork of} the Powder River, speedometer 1797.

Alt. 5,700, sprinkled at dark.

many miles latter part of afternoon was over Pierre shale, still in shale at camp.

South Powder River, Wyo,
Monday, Aug. 27, 1917.

Rained all night, cloudy morning and partly cloudy all day - not windy.

Tried fan belt and waited for road to dry. Started at 12:15. Road very good for much of way but many very rough places and short steep pitches.

5 mi. from camp ^{Heller} ~~Doubt~~ Half acre of variegated clays, with minute bad lead sculpture and monuments, lay S. of road.

Sta. 239, 4 mi. W. of Armintha, small shallow reservoir formed by throwing a dam across a shallow draw. Water

high from last night's rain - 2.5 ft.
wide - 100 ft. long. Stopped to see what
3 herons could be feeding on, found
many dead salamanders, and a few
dead shells of *Lymnaea cockerelli*.

Camped at Lost Cabin at 5 p.m.,
on Badwater Creek - cottonwoods on
bank, water alkaline. Big sheep company
has store, hotel and reservoir.

Speedometer reads 1841. Aneroid
reads 5,500 ft.

Lost Cabin, Wyo., Tuesday,
Aug. 28, 1917.

Hazy morning. Started at 9 a.m., via
No Wood and Ten Sleep road.

Sta. 240, Speedometer 1853, ledge of s.s.
like upper Dakota. Dead *Vallonia* & *Pupilla*
beneath ^{stake} cherry and sage brush, very dry
south slope, 12 mi. N. W. of Lost Cabin.

Sta. 241, creek bottom of Ten Sleep creek,
about 3 mi. above Ten Sleep. *Vallonia*.

Agricolina, *Lombricoides*, *Pyramidula*, *Vitrina*^{+decuss}
under sticks, *Physa* in slough. ^{1 fragment of} *Orthis* ~~exposed~~

Passed Ten Sleep a couple of miles
and made a dry camp on mesa to avoid
mosquitos. ~~Most~~ ^{Most} of road rough + hilly.

Speedometer 1916 miles, alt. 4600.

Partly cloudy, ~~also~~ cool day.

Five mi. N. of No Wood I found a frag-
ment of what looks like a brachiopod in
limestone just above gypsum.

Ten Sleep, Wyo., Wednesday

Aug. 29, 1917.

Partly cloudy morning, hot.

Started at 8:30 a.m.

Hyattville at 10 a.m., speedometer 1931,
alt. 4700.

Sta. 242 overflow creek bottom, willows,
irregular cottonwoods, etc. *Valonia* sp.

Road to Hyattville very rough and sandy
draws, much better after leaving them,
but still many bad places. Had new
connecting hose put in radiator here
and new fan belt put on, also

tightened many bolts to stop
creaking and rattling.

Reached Basin at 1:15; speedometer
1960; alt. 4300, dined at hotel. Had
two new rear casings put on, as old
ones were getting weak. One of them
we brought from Boulder. Also had
brace put under differential. Worked
on machine until 5:30 p.m. Then
camped on river bank half a mile
from town.

Shell, Nyo, Thursday.

Aug. 30, 1917.

Left Basin at 9:30. Took wrong road
so speedometer read 1995 at Shell, though
distance according to road signs is only
26 miles.

Two miles by road N.E. of Shell we found
Trypheaea and Pectenites weathered from
yellowish ^{greenish gray} calcareous s.s. (Sundance formation)

Camped at on Shell 6 ^{mi.} 5 mi.
above Shell at mouth of White Creek
speedometer 2000, alt. 4900 ft

Wall. Sta. 243, camp on Shell Creek 5 mi.
above Shell. *Vallonia* and *Pyramidula* under
in narrow-leaved cottonwood grove. *Physa*,
Succinea and *Planorbis* in slough.

Shell, Wyo., Friday,
Aug. 31, 1917.

Started cloudy, threatening morning.
Walked up Shell Creek along Forest
service trail on S. side.

Sta. 244, l. s. ledges and very small
rock slides about ~~2~~^{2 1/2} mi. above camp;
above Jones ranch. *a. g. striatata* ~~at~~
common, clinging to ledges in plain sight,
no vegetation about ledges except clinging
lichens. Must feed on lichens. Also
found in small rock slides unprotected
by vegetation. None found under good
vegetative cover. Found all along canyon
wall.

Sta. 245; at forest service tool box,
just above 244 and just before
canyon widens upstream. In l. s.

slide composed of small fragments,
O. cooperi pygmaea & *O. y. extenuata*,
the former found for only two or three
rocks, while the latter continued as far
as we to the widening of the canyon
or farther. Found at Sta. 245 also
Yaltonia, *Pupilla* and *Loutoides*.

Sta. 244 is only a mile from camp,
while 245 is $2\frac{1}{2}$ miles up. *O. extenuata*
was found throughout the canyon, but
only collected at 244, just below the
entrance to the narrow canyon, and
245 - just below the upper end of it.
Cold day. Still cloudy at evening.

Shell, Wyo., Saturday,
Sept. 1, 1917.

Rained during night. Cool, cloudy
morning, soon partly clearing.

Walked up White Creek canyon.
A little water in the canyon, which is as
narrow as Shell canyon, but Shell

carries a good sized trout stream.

Sta. 246, shrubbery at foot of a barboiferous cliff at old log cabin on south side of canyon, just within mouth of canyon. *O. cooperi*, mostly very dark, some quite small. Also a white, headed species (rare). ^{*O. extramatis*} Some *Vitruvia*, *Vallonia*, *Pupilla*, etc. Colony covered less than one square rod; good cover of roses and other shrubbery and clematis.

Sta. 247, bluff 150 ft. above 246 where cover is poor, but better than at 244 and 245, *O. extramatis* abundant, clinging to rocks and under scant mt. mahogany, ~~and~~ clematis, etc., a few out on open ground - all active after rain - especially abundant under grass along a ledge. A few *O. pygmaea*.

Sta. 248, about 100-150 yds. above 247, at base of bluff, fair shrub cover, small colony of black *O. cooperi*? with *O. extramatis*. Latter occurs all along the bluff. A few *O. pygmaea*.

Sta. 249, a short distance up the canyon from 248, the vegetation forms a

better cover about ^{small} rock slides. Here
we found the black *O. cooperi* and
O. pygmaea abundant, with a few
O. extremata.

Shell, Wyo, Monday, Sunday,
Sept. 2, 1917.

Bright, hot day.

cleaned snails & packed them.

Shell, Wyo, Monday,
Sept. 3, 1917.

Bright, hot day. started for home
at 9 a.m.

collected *Luxifera* and a fragment of
Pentacrinus asteriscus at various
places N.E. of Shell, and Belemnites at
a higher horizon, with an oyster.

Heard of fresh water mussel in
shell creek at Klucus place (or some)

such sounding name) several miles above the mouth, but our engine was working badly so we did not attempt to leave the good road. We went to the garage at Greybull, then on to Basin, bought groceries, and went on to Hyattville, where we camped and dined at hotel.

Hyattville, Wyo., Tuesday,
Sept. 4, 1917.

Bright morning, partly cloudy and partly windy day, sprinkled a little.

Breakfast at hotel. Packed and mailed 6 parcels of specimens.

Started at 8:30. Road to Ten Sleep and for some miles beyond very rough - made 5 mi. per hour most of time. Better time afterwards. Pretty good road after leaving Howood, especially but hilly. Excellent for mountain road after crossing the divide.

Camped at Lost Cabin at 4:45 p.m.

Lost Cabin, Wyo., Wednesday,
Sept. 5, 1917.

☁️ cloudy, cold windy morning. Wind
blew hard during night. Partly clear
day.

Started at 8:20 a. m., travelled 143
miles & camped by ☁️ North Platte
river about $13\frac{1}{2}$ mi. below Douglas,
at 5:45 p. m.

North Platte River, Wyo., Thursday,
Sept. 6, 1917.

Partly cloudy morning. Rained hard
in afternoon between Wheatland and
Cheyenne. Road very muddy for some
distance.

Lost a new rear inner tube, one
rear chain and my Sigma Xi pair.
Travelled about 140 miles and
camped by roadside south of
Cheyenne about 8 miles.

Cheyenne, Wyo.
Sept. 7, 1917

Bright morning
started at 7:45 a.m.

collected ~~low trees~~
Sta. 250 ^{low trees} "crack" $\frac{1}{2}$ ¹² mi. S. of
Cheyenne ~~to~~ 2 mi. S. of Hoback
line. *Phyza* sp. One *Lycuma* sp.

Reached Boulder at 4 p.m. having
gone by way of Round Butte,
speedometer broke down at
Hyattville, so we have no accurate
record of the distance travelled, but it
was approximately 1150 miles for the
trip.

Started with $8\frac{3}{4}$ gal. gas. $\frac{1}{2}$ to 40¢ per gal.

Bought $70\frac{1}{4}$ " " @ $\frac{26}{100}$ 19.79

" 1.25 grease 1.25

8 gal. left in tank at Boulder.

= $16\frac{1}{2}$ miles per gal. gas.

Repairs on trip 39.14

Expense per mile on auto & running =

Colo. trip 63 days, Inyo. 15 days = 78 da.

Total expense 4.60 ~~9.54 + .44~~ 35-7.24

or about \$4.55 per day, not including
original cost of auto or wear & tear

1917
Lyons, Colo., Sept. 14,

Sta. 951, cross-checked ditch at bridge
below Lyons, Colo. *Pisidium* sp., scarce.

Arkins, Colo.,

May 11, 1917.

Drove from Boulder to Arkins with
P. G. Worcester

Examined Dakota and Morrison
formations where a creek cuts through
ridge about 3/4 mi. E. of Arkins, at
Reservoir. It is west limb of a
pitching (S.) syncline. There is a typical
"Dakota" conglomerate 60 ft. thick, underlain
by Morrison, etc. A thin shale bed separates

this from an overlying sandstone perhaps
15 ft. thick. Above this ~~is~~ a bed of
clay with thin sandstones 30 to 40 ft
thick occurs the clays greenish ~~to~~ and
maroon looking just like the variegated
shales of the Morrison. Then come two
sandstones, each from 15 to 20 ft. thick,
separated by typical black & gray
Dakota shales, with thin s.s. perhaps
15 or 20 ft. thick, then about 400 ft.
of valley occupied apparently by Dakota
shale, while ~~of~~ above (C. of) this
is typical upper Dakota ss. 25 ft.
thick. Within $\frac{1}{4}$ mile N. the variegated
shales disappear, leaving ^{very} a little olive
green shale above the lower s.s., the
lower s.s. and conglomerate coming
together in a high bluff with no
shale intervening, the coarse conglom-
erate grading through finer material
into the s.s., though a narrow bench
indicates a softer zone along the
contact. It looks as though the
variegated shale is a lens in the
Dakota, partly obscured by iron,

which is abundant in the sand-
stones. It looks as though it
plays out within a mile S. as well
as N. of the creek, though we did
not go S.

Eldora, Colo., Aug. 18, 1919.

Went to Eldora by auto stage
with wife & Mr. & Mrs. C. F. French.

Eldora, Colo., Aug. 19, 1919

C. F. French & I rode to 4th
of July Tunnel on horseback, then
climbed to Arapahoe Glacier.

Owing to long, dry season snow
has melted more than I ever
saw it except perhaps the time
Watts, Fenneman & I made the
first survey. At the ~~last~~ terminal
lake and a point W. of it the
shrinkage of ice had been very

great since my last visit, and the front there is very steep, the lake occupying a deep depression back of the moraine. Between these shrinkage areas it has shrunk but little since first observed.

I suspect a ridge here as there is a deep longitudinal crevasse where before I have noticed a ~~the~~ surface stream. I took a photo of it.

Cloudy all day, with a little snow and rain.

Started at 7:30, returned to Eldora at 5:30

Eldora, Aug 20, 1919.
Returned to Boulder this morning.

Eldora, Colo., Saturday

Aug. 30, 1919

Started for Eldora by auto stage at 9:30 a.m. At 12:15 started to walk to Jasper Lake, 7 mi. from Eldora, alt. 10,700 ft., 2,200 ft. above Eldora.

2 or 3 mi. below the lake we found five "inclusions" and other geological specimens that may be secured for display in the museum by taking a wagon up. They are in a boulder field along right hand side of road (going up), not far above where road crosses creek, perhaps a mile or so above forks of creek.

Clear, warm day.

Eldora, Colo., Sunday,

Aug. 31, 1919.

Clear, hot. Climbed to Lake Eldora. Found several species of land snails. Then at lake N.W. of Eldora, several hundred feet higher we found *Planorbis trivialis*, *P. exaeuous* and

Muscularium sp.

Edora, Colo., Monday,
Sept. 1, 1919.

Cool, somewhat cloudy morning.

Norman E. Hinds, Claribel Kendall, Miss McKeehan and Dr. (Miss) Wilkins started for Arapahoe Peak at 7:40 a.m., in John Lilly's wagon, with a saddle horse for Norman to ride back on in time to catch the ~~morning~~^{evening} stage.

Fourth of July tunnel at 9:30.

Miss Kendall accompanied Norman and I, the others following, Miss Wilkins reaching the saddle, Miss McKeehan going only to the end of the trail, where she could see the saddle.

We crossed the cirque. The snow has melted from the ice clear to the bergschrund, and the crevasses were open wider (and more of them) than I ever saw before.

The longitudinal crevasse mentioned in notes for Aug. 19, 1919.

~~The~~ W. of lake, is wide open, and there are indications of several others, as though the ice has developed flow laterally into the lake on one side and into the deeply eroded valley in the ice on the other, thus stretching at the top and fracturing.

Terminal lake has melted more deeply into the ice and is much larger, water milky, no boulders exposed in it. Valley W. of lake more deeply eroded in the ice. Point of the ridge of ice between lake and Valley, ~~is~~ end of ice is 40 ft (measured) below the ^{lower edge of} big boulder near top of ^{terminal} moraine. Ice on N.E. edge is about 40 ft below great boulder on lateral moraine, but the boulder has tilted forward down slope in recent years. The lateral moraine is cracking and falling away from the cirque.

Wall owing to removal of support
by shrinkage of ice.

Slope of ice from to terminal
lake 16°.

We passed up N. wall at N.
end of E. lateral moraine, and over
into next cirque, where we found
the ice sheet to be a true glacier,
as I had suspected. The bergschrund,
about $3/4$ of way ^{up} from bottom, is
wide open, consisting of several
large crevasses extending across
face of ice. Differential flow
plainly shown by marked
band of stratification lines. Two
big icebergs floating in lake, and
another breaking off. Water of
lake not milky.

Began to snow and rain at
12:30, continuing most of time all
afternoon until we reached.

Elbow at 7:10 p.m.

Miss Kendall & I crossed N. & S.
peaks. Huck left us at the glacier
to return to Denver.

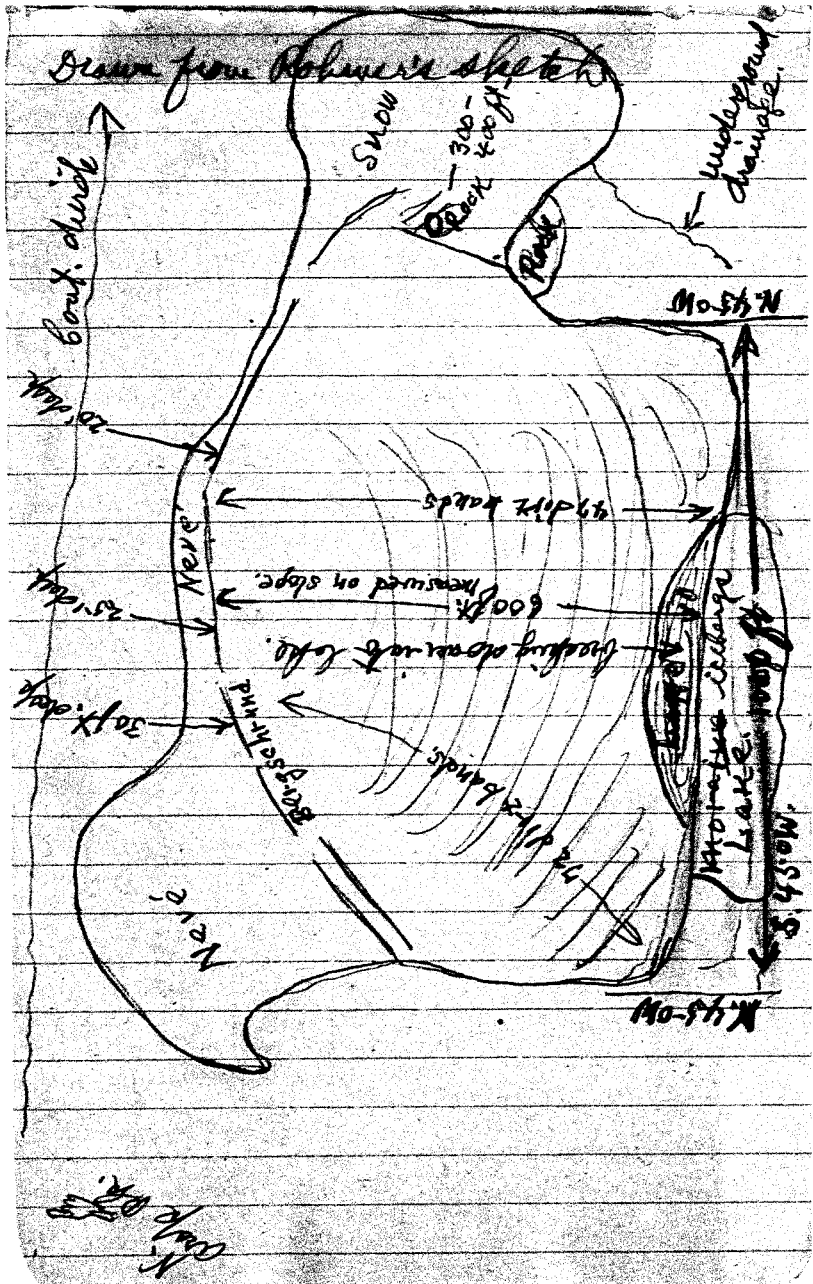
Boulder, Colo.

Sept. 12, 1919

I sent Frank W. Rohrer and Rudolph Johnson up to University camp, below Silver Lake, yesterday to examine and photograph North Arapahoe Glacier. They went up today, cloudy all day, stormy afternoon. Supposing the cloudy day required long exposures, regardless of my instructions to expose $\frac{1}{10}$ to $\frac{1}{25}$ sec. with 32 stop (U.S.), they exposed 10 plates $\frac{1}{2}$ sec. & 4 plates $\frac{1}{5}$ sec. Result: all overexposed, mostly wholly worthless.

Width of exposed ~~ice~~ ice ^(measured) 1100 ft. Snow extending N. of ice 300 or 400 ft. (estimated). 72 dirt bands counted from S.E. corner of glacier to 47 from E. front. 600 ft. ^{wide} from E. front along axis N. 45° W. ^{slope} 30° S, 50° E. at middle. Bergsund clear across, in places 20-30 ft. wide - 22-25 and 30 ft. deep. Rock flour plain in water of lake, sage Johnson.

Drawn from Robinson's sketch



GLACIER DISCOVERED BOULDER WILL AFTER PROF

A large body of snow and ice on the Arapahoe Peaks is a Glacier and a movement is on foot to name it after Prof. Junius Henderson, curator of the University, and discoverer of the new glacier. Frank Rohwer and Attorney Rudolph Johnson returned to Boulder this noon from an investigation of the body of ice, having been sent there for that purpose by Prof. Henderson.

Mr. Johnson stated this afternoon that there could be no question about the snow field being a Glacier. It is located at an altitude of 13,000 feet and is about 1,000 feet wide by about 600 feet in depth or height. It is on the slope of Arapahoe peak at a higher elevation than the Arapahoe Glacier. It was discovered by Prof. Henderson last month while on his annual trip to Arapahoe Glacier to measure the movement of the glacier for the year. Prof. Henderson has made annual measurements for more than a decade.

By cutting steps into the new Glacier Messrs. Rohwer and Johnson were able to make a complete survey and make an approximate measurement. They counted 47 rings, each

ed that he
of individu
Raphaelites
ere should b
ackett

COLORADO E
COF

Over the des
laud business
"There is no f
a fact that sho
to every boy
of them are le
The man or wo
nite work to-d
real enjoyment.
in "

*Boulder Banner
Sept. 19, 1917.
about five feet thick, which indicate
the age of the glacier. Above this they
counted 30 rings of snow. The Glacier
is traversed by great crevasses, one*

DEATH SLIDE

DEATH SLIDE ON GLACIER IS HALTED BY PICK IN ICE

*Rocky Mt.
News
Sept. 14, 1919*

Explorer Loses Footing on
Face of Crevass, Barely Es-
caping Drowning in
Freezing Waters.

*Rocky Mt. News
Sept. 13, 1919*
Special to The News.

BOULDER, Colo., Sept. 13.—Frantically trying to stop his swift descent down a steep 600-foot incline of smooth ice, with a glacial lake of unfathomed depth waiting to receive him below, Rudolph Johnson, Boulder attorney, narrowly saved himself from being drowned in the icy waters by digging his pickax into the wall of the incline. Johnson, with Frank Rohwer, Boulder geologist, was exploring for the first time a glacier discovered by Prof. Julius Henderson, curator of the University of Colorado, two weeks ago.

The explorers were making the ascent of the wall of ice by digging out steps with their pickaxes. At an elevation of 350 feet Johnson's foot slipped from the step he dug into the perpendicular face of the ice wall.

April 9, 1921.

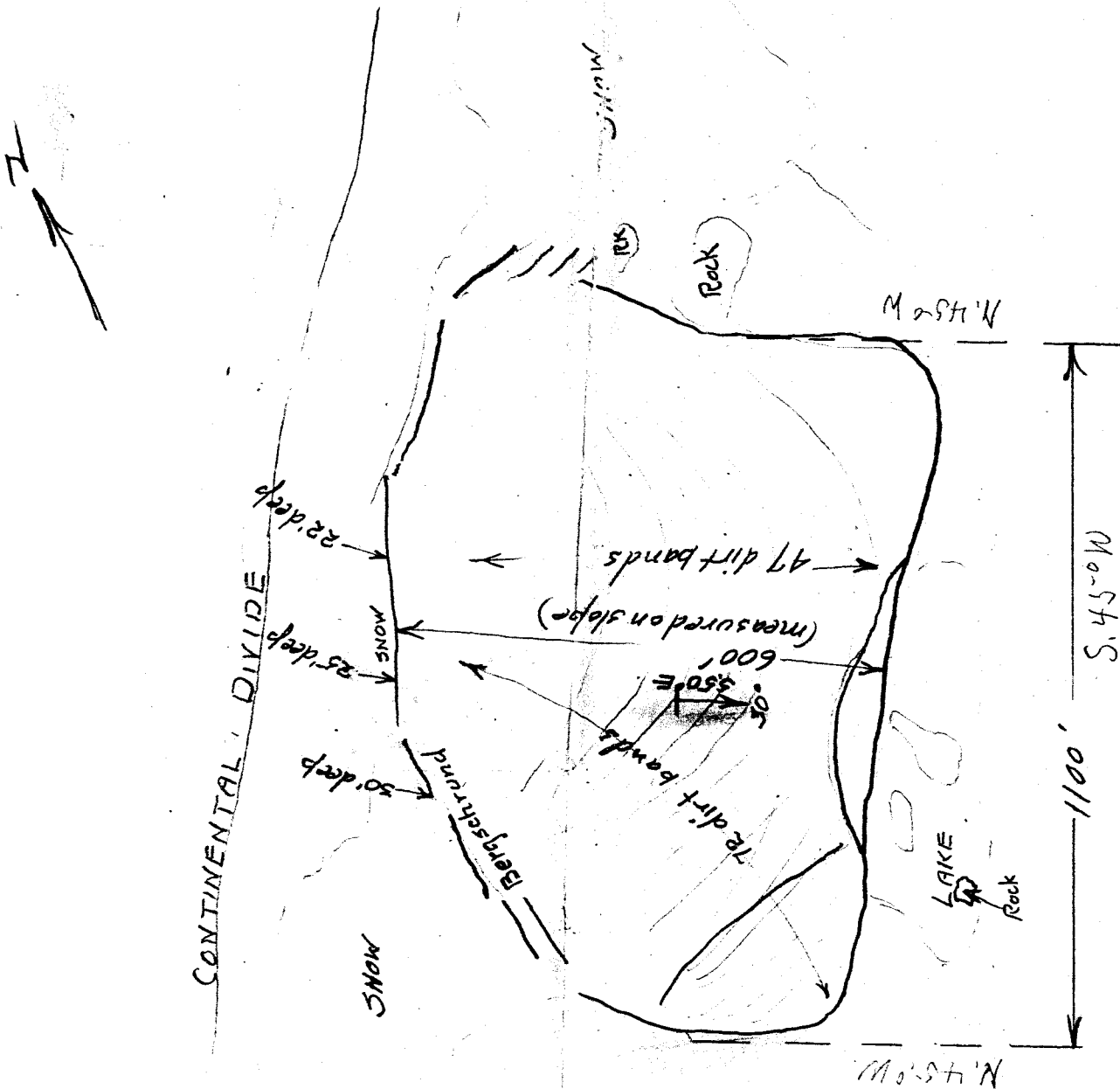
Memorandum for Boulder Commercial Association.

-0-

After having stated in my report on the glaciers of Colorado in 1910, that the North Arapahoe ice body should not be called a glacier (see page 69 of report), I concluded, from a reexamination of a photo that I had obtained the previous year, that there was a well-developed bergschrund, and that therefore it is a true glacier, though the photo was taken at an unfavorable season, so did not clearly show its character. In 1919 I visited it again, in one of the most favorable seasons we have ever had for glacier observation, and found the bergschrund wide open, the snow melted from the entire surface of the ice, thus beautifully showing the evidence of movement in the decided curving of the dirt bands, but as a blizzard was raging at the time I was unable to obtain photos. Later I paid the expenses of Frank W. Rohrer and Rudolph Johnson to visit this glacier, study it and obtain photos. Bad weather prevented them from getting photos, but they made measurements, as follows: Length from the foot of the ice to the bergschrund 600 feet, measured along the slope, not corrected for slope, etc.; width 110 feet; depth of bergschrund from 22 to 30 feet and width up to 20 feet or more. Dirt bands, representing seasons of snowfall (annual), 72 counted.

~~There can be no doubt from all the evidence I now have that this~~ is an active glacier, and I have been calling it North Arapahoe glacier in my lectures for the last eight years, though it has not yet been published as such. It is my earnest wish that this should be called by that name. I have excellent reasons for emphatically objecting to calling it Henderson, as has been proposed in certain newspapers, and feel that my wishes should be respected.

North Arapahoe Glacier,
 Sept. 12, 1912 - By Frank W. Rowser.



13506
 N. Horn
 Arapahoe

Footings Regained.

Johnson clawed at the ice wall with his pick until he gained a footing on a step. Had he been carried in the course of his slide down the wall of ice out of the line of the steps dug in the ascent nothing could have stopped his precipitous fall into the lake below.

After his escape Johnson, with the aid of Rohwer, began again the perilous task of hewing out a stairway to the top of the ice wall.

The ice floe which the explorers were surveying was discovered by Professor Henderson two weeks ago while climbing about 1,000 feet northeast of the north point of Arapahoe peak. He sent Rohwer and Johnson to the place yesterday to determine whether it was a glacier or a snow-bank.

Glacier Exposed.

The body of ice had been visited by former climbers, but until this year it had always been snow-covered and was believed to be a snow drift. This year the snow was melted off, leaving the ice exposed.

The explorers are positive that the ice body is a glacier. They found giant crevasses from thirty to forty feet deep and in some places 200 feet long, bergshrunds, rock flour, lateral and terminal moraines, and other characteristic marks of the glacier. The length of the glacier is 1,100 feet, and it is 600 feet in height.

Johnson and Rohwer descended into one of the crevasses and found in it caverns and chambers of great depth and size. The men scrambled into the crevasse with great difficulty and at great risk. A misstep meant death by a fall of thirty feet or more. At times their hands became so cold that they could hardly hold the picks with which they dug out steps in the ice.

After reaching the top of the

glacier the men tried to descend the ice, but finding that night was drawing on, and that the descent would be too hazardous to attempt in the dark, they descended by the land side.

Forty-seven annual rings were found in the solid ice and above this were thirty rings of snow-ice. This indicates, according to Johnson, that the accumulations have been there for seventy-seven years. The glacier has been slowly sliding down for many years, so that it is impossible to tell the exact age of the ice body. The explorers are making an effort to have the glacier named "Henderson," after its discoverer.

NEW GLACIER LARGER AND PRETTIER THAN ARAPAHOE SAYS PROFESSOR JOHNSON

Boulder Camera Club, Sept. 22, 1919

The North and South St. Vrain glaciers at the headwaters of the Middle St. Vrain creek were explored last week by Attorney Rudolph Johnson and Warren McGuire for Prof. Junius Henderson of the University of Colorado museum. They located a new glacier on the trip and took pictures of it and the two mentioned. Mr. Johnson stated this morning that the North St. Vrain glacier was larger and every bit as pretty as the Arapahoe.

"I saw land avalanches one after the other," said Mr. Johnson this morning. "I saw several different slides at the same time. There was a continual rumbling of falling rock. The north glacier bulges out more prominently than the Arapahoe and is lined with crevasses and other distinguishing marks of glaciers. McGuire became sick just before reaching the St. Vrain glaciers and I left him and went ahead. When I came back I saw him keeping company with a mountain lion. They were not very friendly. The lion, however was but a short distance away. Neither McGuire or I had fire arms."

Glaciers on Middle St. Vrain
Creek, Boulder, Co., Colo.

#

Report of Rudolph Johnson
copied by J. Henderson from Johnson's
typewritten report.

Sept. 30th, 1919

Professor Junius Henderson

University of Colorado, Boulder, Colorado

Dear Sir:

as [per] your instructions I proceeded
to Stapp's Lake Lodge on September 18, 1919, accom-
panied by Warren Mc Guire, and on Friday,
September 19, 1919, ascended to the St. Vrain
Glaciers, at the head of Middle St. Vrain
Creek.

We followed the Buchanan Pass Trail from
Stapp's Lake to a point within a mile and a
half or two miles of the Pass, left the trail
at an altitude of about 10,500 feet and
travelled to the north to a small un-named
lake owned by Frank Hickey, from

there we went to the west without trail some-
what below timber line, keeping parallel with
and about 1,000 yards above the Middle
St. Vrain Cracks. The glaciers did not appear in
view until we reached a knoll extending out from
the range, in section 11, T. 2 N., R. 74 W., from which
point the north glacier showed at a dis-
tance of two miles to the west.

At our left 1,000 yards away a smaller body of
ice and snow appeared, which I erroneously
thought to be the south one of the St. Vrain glaciers.
I was led into this mistake by errors on the
map. The rounded knoll which we were on and
which was a group of very distinct rock mountains
was not indicated on the map at all. I figured
on crossing three large streams as shown on the
map, on the journey from Hiskey's Lake to the
glaciers, and had already crossed three and
was coming to the fourth stream, and made the
mistake of thinking that this was the stream
coming from the South glacier of the St. Vrain.
The map was the United States Survey of the Long's
Peak Quadrangle. One stream had been left out
of the map; two rather large mountains or
shoulders from the range were not indicated;
and instead of one lake on each stream in

Section 11, T. 2 N., R. 74 W., there are in reality three lakes on each stream.

This first body of ice we explored at some length, not knowing until later that it is not one of the St. Vrain glaciers. It had the characteristics of a glacier, and although of small size, seemed to be a true glacier. It is plainly a remnant of a glacier formerly extending down the valley, but may however be so far extinct as not to be classed as a glacier now. This new or unknown glacier is headed due north [evidently means moving north, as it is on S. side of valley]. A tongue of snow extends down the mountain side from the top of the range some 1,000 feet in length, spreading out into a fan-shaped body of snow or neve 200 feet long and 200 feet wide, at an angle [slope] of 35 degrees. At the bottom of this fan-shaped body of snow is a deposit of rocks, in a circular rim across the field. On both sides of this tongue of snow are additional bodies of snow, one to the east showing annual rings and several bergschunde. Beyond and below this rim of rock deposit is the glacier proper, extending downward 467 feet from the rock

slide to the bottom of the ice, and being 480 feet wide. This lay at an angle [dip] of 20 degrees at the top, flattening out to 15 degrees in the middle, and less than 10% degrees at the bottom. On both sides of the tongue of snow, above the ice, were bergschrunds. One on the east side showed 8 layers of snow, was about 70 feet long, and extended into a cave 30 feet long, 20 feet wide, and 6 to 10 feet high, the rock bottom having an angle of 35 degrees. Steam was rising in this cave, from the action of the sun. A bergschrund ran along the west side of the tongue of snow in a curve, extending along the upper edge of the snow ice for 100 feet, and where the glacier spread outward it was joined by a cave extending downward under the ^{snow} ice, and ~~snow~~ forming a pretty cavern 100 feet long, 25 feet wide, and 6 to 12 feet high. There were no crevasses in this body of ice of sufficient size to be called such, although cracks were numerous. Several streams wandered over the ice, one along the west side being quite large and carving a meandering valley one or two feet deep. This glacier is very dirty, and rocks are numerous over the surface. The upper half was covered with snow at the time

of my visit, intermingled with rocks. Several small rock tables were seen. One could hardly discern the rings, and could not count them because of the rocks and dirt and snow covering the field. While we were at this glacier three rock slides came down. Along the east side of this ice, and at the bottom, are very dirty and muddy moraines, 10 to 25 feet high, 50 to 150 feet wide. Under these piles of rock, ice was found nearly at the surface, and in one place 20 feet from the edge of the glacier, ice was found under the morainal material at a depth of 8 inches. The moraine to the east contained long cracks, which we could not account for until we discovered the ice under the debris. The nearest lake was at a distance of 150 feet from the ice. Another lake is east of this one, fed by streams from other snowdrifts, and water from the two lakes flows by separate streams into a third lake. The water in the stream from the ice field was slightly discolored.

Before coming to this glacier, while viewing the region from the point of round

rocks, I noticed a small body of snow and ice that appeared to be a glacier, to the south, just below the top of the range, about on the line between sections 11 and 12, T. 2 N., R. 74 W., at a distance of about a mile away. Annual rings could plainly be seen. Above the center of the body of ice were what appeared to be large crevasses, and near the top were definite bergs-hrends. We did not have time to explore this body of ice, but from appearance it might warrant investigation to see whether or not it is a true glacier.

Proceeding around the mountain side from the new glacier and starting the ascent to the St. Vrain Glacier, my companion, who had for some time complained of illness, became so ill that he was unable to climb further, and rather than return without exploring the glaciers, I left him at a small lake down in the bottom of a deep glaciated canyon, the middle St. Vrain, and climbed to the glaciers above. This lake, which is not named, had a white or bluish color in the water, very distinct. My companion remarked upon seeing it, asking where the mine tailings could come from in this

region. It was so discolored that one hesitated to drink it. The stream coming into the lake was so highly colored that white sediment was deposited on the bottom and along the sides.

Making a difficult climb of over a mile to the outlet, I found that the body of ice we had visited was not one of the St. Vrain glaciers, for on ascending the enormous pile of moraine matter which filled the bottom of the canyon, seemingly for hundreds of feet deep, I suddenly found spread out before me the two glaciers we had come to explore. The two ice-fields lay at a distance of several hundred yards apart, with ⁱⁿ small bodies of ice and snow, one long lateral moraine, and numerous piles of rock between.

The south glacier has a direction of flow to the northwest by east, and a ^{slightly} ~~rather~~ uniform angle over the whole mass of 25 degrees, except at the upper edge where the snow becomes steeper and deeper at the

lower end where it flattens out in the last hundred yards. It is very dirty, rocks and debris of all sizes laying thick over the whole surface. The north side of the glacier, for a width of 250 feet or more, is especially thick with rocks, most of this part being entirely covered with rock drift. At a distance of 60 feet from the northern edge is another drift of rock, running nearly the whole length of the glacier, 5 feet high and 50 feet wide. Beyond this 250 feet there are still numerous rocks, forming occasional rock tables. The entire glacier was still covered with snow, and one could barely discern the rings [bands], for the ice showed through the snow only in a few places. Except near the top where the snow field becomes more perpendicular and difficult to climb, one can walk over the entire surface of the glacier with safety. Along the ~~sub~~ entire top is a large bergschrund, in some places 30 or more feet wide. I saw a number of small crevasses near the center. Near the central southern border are two large crevasses extending across the glacier for a distance of over 100 feet, 5 feet wide and from 5 to 20 feet deep. As I was alone I could not measure the glacier, but estimate its length to be 2,000 feet and its width

1,000 feet. At the bottom the moraine rises up 20 to 50 feet above the foot of the ice, and beyond the first moraine is a series of ridges and piles containing immense masses of morainal material. There is no lake at the bottom. The water issuing from the ice is very white with rock flour. Along the north side, between the north and south glaciers, is an immense moraine, 100 feet or more in height, running down the slope over 1,000 yards. Numerous ~~abrupt~~ ^{abrupt} ~~falls~~ were heard while I was at this glacier, rocks seemingly falling all the time, and occasionally falling in several places at the same time. This was the only danger encountered on the south glacier.

The north ~~of~~ glacier of the St. Vrain pair is an immense body of ice, bulging out prominently on the mountain side, in a cirque of rugged peaks. The flow of ice is directly east. The face of the glacier, the lower part of the bulge, which is the only part that can be seen from the moraine at the foot, was free of snow and showed the rings plainly. The upper part, back of the bulge or crest, was snow covered at the time of my visit. The glacier was fairly free of rocks, and looked very clean in comparison with the south glacier. There were only occasional small stones, except near the northern border where the rocks completely covered the

ice for a width of 50 feet, running down the glacier, and ~~up~~ for a considerable pile of large rocks in a series of crevasses in the south central part, about 300 feet from the south edge. I could not measure the glacier alone, and guessed at the dimensions. The width is at least 2,000 feet, possibly 3,000 or more. The lower part, from which the snow had melted off, has a length up the slope of over 1,000 feet, possibly 1,500 feet, to the rounded crest. It does not flatten out very much toward the bottom, and has a slope too steep to climb without cutting steps in the ice. The ^{ridges} are evenly circular ^[should be] [curved].

The ice mass is furrowed with streams of water running down. None of the streams were very large, and I found no very striking examples of meandering. This ice surface is fairly free of rocks, except at the edges, and I saw no rock tables. There is no lake at the bottom. The water escapes through ⁱⁿ a tunnel bored through ~~at~~ a moraine of mingled ice and rock, 40 feet under the top of the moraine. The terminal moraines are very large, rising some 50 feet above the foot of the glacier and extending in great masses down the canyon. At the rounded crest there were a large number of crevasses of all sizes, the largest being in a group about 300 feet out from the southern edge, just back of the crest. Some of these were as much

as 20 feet wide and over 30 feet deep. Above this group of crevasses is a group of smaller crevasses surrounded with large rocks, lying on the ice and filling the crevasses. Back of the crest is a snow field the entire width of the glacier, nearly level, slightly rolling and extending back a distance of over 1,000 feet, probably 1,500 feet to the bergschrund. There were a number of crevasses in this snow covered field, and in one place a crevasse extended into a canal covered with a snow roof several feet thick, running into the darkness 100 feet or more, 20 to 30 feet deep. Doubtless there are many unseen crevasses thus roofed over. The bergschrund, or series of bergschrunds, extended along the entire upper border, sometimes near the rock wall and at other times out from the wall 100 feet or more. In some places a person might scramble across to the mountain wall, but generally the crossing would be exceedingly difficult. In most of these bergschrunds the bottoms were filled with rocks falling down from the walls above. While I was taking a photograph a rock slid down and fell into ^{at} the bergschrund at my feet. Avalanches were very numerous, although most of them seemed

to be falling on the south glacier. Almost any minute while I was there, from 3:30 to 6 p.m., rocks could be heard falling. The continuous noise caused me to time the falls, and while I had my watch in my hand, for a period of half an hour, the longest time between the rock falls was five minutes. At one time, a large quantity, about half a carload, fell along the north wall. [By avalanche he means merely falling rocks.]

In appearance the north glacier has a very steep surface near the upper banks of snow, curving upward at an angle of impossible to scale; then the snowfield covering the ice levels out for 1000 feet or more, to the crest, and then rounds out into a beautiful bulge of even shape, dropping off in a rounded slope of ice, at too steep an angle to climb without difficulty, ending in masses of rock. Viewing it from the moraine at the foot, one sees the ice body bellying out like an immense ball, hiding the snow field back of it, and presenting a striking appearance its parallel rings and downward streaks.

I did not have time to climb the canyon walls to obtain an extensive view, and could only photograph portions of the glacier at a

a time. I believe one can secure a photograph
of the whole cirque and both glaciers from
Mount Galbraith on the north wall, or from
the ridge extending east from this mountain.
One might also secure a picture of the whole
area from a spur extending north from the
range just east of the South Glacier. When I
visit the glaciers again I intend to follow
the Buchanan Pass trail to the top of the
Pass, and then travel along the continental
divide on top of the range to the cirque
containing the K. Vrain glaciers. It is my
opinion they can be reached much easier
this way than from the canyon.

(Signed) Rudolph Johnson.