

Record of Minerals Collected from Larimer  
County for Use in Type Mineral Collection of  
Colorado Agricultural College, with Notes  
on Location and Occurrence.

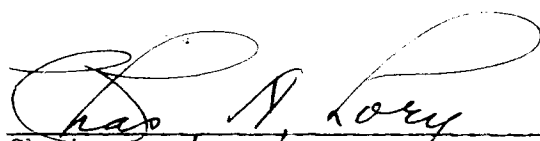
By


Roy G. Coffin

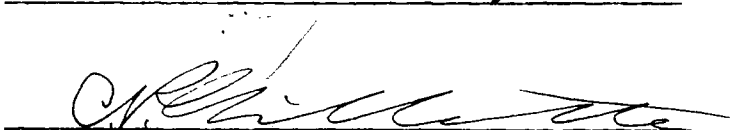
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THIS THESIS HAS BEEN APPROVED AND RECOMMENDED FOR  
THE DEGREE OF MASTER OF SCIENCE



  
Chairman






Committee on Advanced Degrees  
Colorado Agricultural College  
Fort Collins, Colorado

EXAMINING COMMITTEE

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### ACKNOWLEDGEMENTS

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## PURPOSE AND SCOPE OF THIS REPORT

The subject of the occurrence of Primary and Secondary Minerals in Larimer County is practically untouched by printed manuscript, and the purpose of this paper is to make a preliminary report of geological studies being pursued by the author; calling attention to the great variety of minerals found in Larimer County, and cataloging those that can be considered of such perfection of form or occurrence as to be of use in the Type Mineral Collection of our institutional department of Geology, also designating the location of the most important occurrences as known to him.

The number of minerals represented is great and in most cases quite varied in form in the several localities where found. This report does not propose to touch on the description of the specific crystal form or other variable characteristics of the same mineral.

While most of the sections of the county have been visited, many have not been examined critically enough to insure this as being in any way a complete catalog of mineral occurrences in the county, while the economic phase is not a matter of consideration.

The majority of our local minerals are secondary and the metamorphic materials have resulted from both contact and extensive regional metamorphism. Each mineral therefore, in

itself, presents subject matter for exhaustive study.

The scope of this report does not attempt a study of the magmatic conditions under which these minerals in their various phases, were produced, but is confined primarily to their distribution and associations.

The chief purpose of this study was an endeavor to collect and identify local minerals suitable for type and working collections to replace a representative and valuable collection lost in the Chemistry Building fire in 1922.

Following this loss the author was given the assignment as instructor of geology and it became necessary to obtain minerals for departmental use.

This report is submitted as representing a record of collections made during the summers and other vacation times of the years 1922 to 1928 inclusive. Many well developed minerals have been obtained from the local metamorphics that have not as yet been identified.

#### Lithological Divisions of Larimer County

Larimer County is divided into three more or less distinct zones.

1st. The Plains Region, extending from the eastern boundary of the county westward to the base of the mountains and including the "hogbacks" of the foothills.

In this zone, the upturned eroded edges of the underlying sediments are exposed, and embrace an almost continuous

and complete series from the Pennsylvanian Period to the late Cretaceous Period.

Throughout this area the strata have a profound easterly dip from the mountains.

#### 2nd. Volcanic Zone.

The area embraced in a narrow strip along the west boundary coincident with the Poudre-Platte Divide, might be termed the volcanic zone. It is more or less a region of eruptions and shows extensive volcanic activity accompanied by considerable faulting and folding, which has brought some of the more recent sediments in contact with the Pre-Cambrian metamorphics.

The materials in place are represented by extensive flows, intrusive masses, dikes, and an extinct crater.

#### 3rd. Metamorphic Zone.

The greater portion of the county is a metamorphic mountainous area between the sediments on the east and the high volcanic crests on the western border. Throughout this area, gneisses and schists of great variety are represented. Through these well banded materials, great batholithic masses of granite and coarse pegmatite veins have been forced.

The general bedding of the metamorphic structure is nearly vertical and from the sediments the strike is west by northwest.

### Volcanic and Plutonic Materials

At no place in the plains area is there known to be intrusives in the sediments as is the case in the North Park area of Jackson County on the west.

Many small dikes of highly basic materials are found throughout the metamorphics. These intrusions are more common nearer the sediments than in the higher mountains.

The entire area of metamorphics is crossed in all directions by very coarsely crystallized pegmatites.

These veins have no uniformity either in direction or composition. Many are intruded sheets along the nearly vertical schistose bedding, while some of the most persistent are nearly horizontal and extend practically parallel in groups of two or more.

It is in these veins and in the schist contacts that the larger and better formed crystalline minerals are secured. Garnets, tourmaline, beryl, rose-quartz, orthoclase, plagioclases, microperthite and staurolite are among the more common.

Large dikes of grey and of white porphyry are not uncommon in the higher mountains, but are not known near the sediments. Near Profile Rock in Poudre Canon and west of the Red Feather Lakes large masses have been noted. A large portion of Specimen Mountain is intrusive rhyolite.

From Specimen Mountain north through the Trap Lake District to Chamber's Lake are extensive extrusives consisting mainly

of rhyolite, pitchstone and more compact acidic and porphyritic materials, many of which furnish the hard felsitic boulders common throughout the gravels of the Poudre drainage.

Near Chamber's Lake the lavas are more basic and are scoriaceous and amygdaloidal in many places.

Horse-tooth Mountain, Grey Mountain and the north portion of Milner Mountain are examples of the many batholithic granitic masses that are common throughout the metamorphic area.

From Halligan Dam to the mouth of the canon (about five miles) the North Poudre River traverses an area almost exclusively granitic. This massive granite extends east and north through the Virginia Dale district to the Colorado-Wyoming line. From Owl Canon north to the state line the sediments are in contact with this granite. The basal Fountain arkose of this contact is found to be of the same materials as the granite and in many places is untransported.



CATALOGUE OF TYPE MINERALS FROM LARAMIE COUNTY USED  
IN THE MINERAL COLLECTION OF COLORADO AGRICULTURAL COLLEGE

Alabaster, See Gypsum

Andalusite

Pink and white to gray, cleavage masses associated with pennenite and sillimanite

1. Empire Copper Mine,  $\frac{1}{4}$  mile below
2. Buckhorn, 6 miles above Masonville

Apatite

Pink to red finely crystalline to fibrous.

1. Near Glendevy, Laramie river

Aragonite

- I. Pseudo-hexagonal tabular, minute to 3 inch crystals.

Color, yellowish to red, iron stained.  
Lykins Formation, above, and in the Gypsum horizon.

1. East of Owl Canyon
2. Campbell Spring Draw.
3. Sand Creek (of Boxelder District)
4. Boxelder Creek

- II. White encrustations in limestone caverns of Ingleside Formations.

1. Ingleside limestone area.

- III. Brown Mexican Onyx (compact).

1. East of Pinon Pine district in the gypsum of the Lykins Formation.

- IV. White to yellow onyx (compact) in limestone caverns of Ingleside Formation.

1. Ingleside quarries
2. Pinon Pines
3. Owl Canyon

V. Large bivalve shells of Niobrara Formation.

Asphalt (see Bitumen)

Azurite

Encrustations only, are found in many prospects of the county.

1. Empire Copper Mine
2. Prairie Divide
3. North Fork Thompson River Canyon.
4. Upper Red-stone Canyon.

Barite

- I. Cleavage masses, (small) of white to creamy, in granite.
  1. Pingree Park, 3 miles west of Forestry Lodge.
- II. Massive, white.
  1. Lory Hi from drift (one specimen only)

Beryl

Common in the pegmatites of the Thompson Canyon and Buckhorn districts and uncommon in the sections both north and south.

Large, (up to 6 inches in diameter), color yellow, green to blue-green.

1. Top of Crystal Mountain, in white quartz.
2. North talus slope of Crystal Mountain and in the feldspathic pegmatites.
3. Fish Creek, south of Crystal Mountain.
4. Buckhorn Mica Mine.
5. North Fork of Thompson on Storm Peak Road.
6. Lory Hi, one mile east.
7. Big Thompson Canyon, one mile above Forks.

Biotite, known in many schists and pegmatites

- I. Large flakes.
  1. Chamber's Lake

II. Coarse Schist, large isolated masses in intrusive granites (often almost pure)

1. Big Narrows, Poudre Canyon
2. Poudre Falls.

III. Coarse Gneiss

1. Water Works Hill, Poudre Canyon

IV. Coarse flakes, with microcline-microperthite in pegmatitic intrusions.

1. Water Works Hill, Poudre Canyon
2. Rist Canyon
3. Hill's Gulch

V. With garnet

1. Water Works Hill
2. North Poudre Canyon 1 mile above Water Works

Bitumen

I. Gilsonite (?) 25 miles north of Fort Collins the Niobrara Formation contains isolated bitumenized masses which are probably derived from wood.

1. Elmer Cooke Ranch and north.

II. Asphaltum - elaterite from Big Muddy Dakota sandstone crevices

1. Campbell Spring Draw

Calcite is most common in the Ingleside Formation. as crystals and massive. Metamorphics and eruptives also contain isolated masses.

I. White and yellow in geodes in amygdaloidal basic lavas

1. Chamber's Lake district and south to Little Joe Wright Creek in basalt.

II. In felsitic geodes with chalcedonies.

1. Specimen Mountain

III. Coarse Marble, Pre-Cambrian.

1. White,  $\frac{1}{4}$  mile east of Empire Copper Mine (4 miles west of Fort Collins.)
2. With chlorite, 200 yds. north of mine.
3. Pink, with chlorite, north of mine.

IV. White, with hornblende.

1. In Empire Copper Mine.

V. White with garnet, serpentine, and hornblende.

1. Water-line tunnel at Stearley's Cabin, Poudre Canyon.
2. Stove Prairie Landing, Poudre Canyon.

VI. White enclosing green and red garnets.

1. Water Works Hill, Poudre Canyon.
2. Stove Prairie Landing.
3. Pingree Park, 3 miles west of Lodge.

VII. Marble; banded grey and white.

1. Cameron Pass Road.

VIII. Marble, compact, Ingleside Formation.

1. Pink, white, creamy are found at Ingleside, and north throughout the several east-west canyons of the Boxelder District.

IX. Marble, Dolomitic

1. Yellow to pink, in Ingleside quarries and thru the Boxelder district.

X. Calcite crystals, Ingleside Formation cavities.

1. Dog-tooth spar
2. Nail-head spar
3. Iceland spar, from large scalenohedron crystals.
4. Iceland spar, from crystalline masses in Pinon Pine area.
5. Golden yellow, south of Ingleside, P.O.  
Deposited as a section of radiating calcites, lining large cavities.

6. Radiating white yellow to transparent crystals up to 2 ft. in length,  $1\frac{1}{2}$  miles south of Ingleside, P.O.
7. Banded stalagmitic, in caverns at Ingleside.
8. Pseudomorph after travertine, light yellow to pure white in large curved cleavage masses, shows onyx banding, in caverns at Pinon Pine quarries and in the ravines below.
9. White, cleavage masses, throughout the brecciated red sandstones of the lower Ingleside and upper Fountain Formations.
10. Scalenohedron crystals coated with limonite and covered with radiating yellow calcite over which is deposited compact travertine. Ingleside and canyon 1 mile south.
11. Stalactite, stalagmite and travertine forms in cavern at Ingleside, P.O.
12. Mexican Onyx, compact, brown banded, in gypsum beds east of Pinon Pines. (4 mi. north of Ingleside).
13. Warped cleavage, see pseudomorphic after travertine #8. White and yellow.
  1. Pinon pines
  2. South of Ingleside (1 mile)
14. Calcareous tufa, Redstone Canyon about  $\frac{1}{2}$  mile north of Estes Park Road.
15. Calcareous tufa deposited over sticks, roots, moss etc., Campbell Spring Draw.
16. Nailhead-spar. Flat rhombohedron and prism. Large ( $3\frac{1}{2}$  inches in diameter) in seams along fault zones in Benton-Niobrara Formation. West and northwest of Round Butte. Elmer Cook's Ranch.
17. Fibrous travertine.

Morrison-Dakota contact west of Spring School House.  
Table Mountain, Boxelder Creek.  
North of Greenacre Ranch.
18. Cuboid rhombohedron.

Southwest of Goodwin Ranch.

19. Chalk, argillaceous, in Niobrara-Benton Formation

White to yellow with yellow to purple precipitation bands. Lindenmier's Ranch near Colorado-Wyoming line.

20. Deep red, containing colloidal clay and hematite. Fine to very coarsely crystallized with much-warped cleavage. 1 mile south of Ingleside.

Chalcanthite, crusts and small crystals.

1. Empire Copper Mine.

Chalcedony (see Quartz)

Chalcocite, granules and isolated masses, with fluorite and malachite.

1. North Fork of Thompson on Redstone Divide.

Chalcopyrite

I. In pegmatite and finer intrusives, as grains and lenticular masses.

1. Chamber's Lake
2. Poudre Falls
3. Water Works Hill Poudre Canyon.

II. In hornblend schist and gneiss

1. Empire Copper Mine (large masses)
3. Big Narrows, Poudre Canyon
5. Sheep Creek near Colorado-Wyoming line with chlorite.

III. In biotite gneiss

1. Prairie Divide

Chalk, see calcite 19.

Chert

I. Concretionary masses of yellow to purple with black dendrites in Ingleside Formation limestone.

1. Boxelder canyon
2. Haygood Canyon

II. Grey concretionary flint masses up to several hundred pounds. Morrison Formation.

1. Campbell Spring Draw.

III. Fossil bearing concretionary masses as pebbles in lower Fountain, arkosic conglomerate.

1. West of Owl Canyon at Fountain-granite contact.  
2. Tertiary (?) Conglomerate at Round Butte.

Chlorite is quite common throughout the metamorphics, especially through areas of faulting and brecciation.

1. On road  $\frac{1}{4}$  mile below Copper Mine.  
2. Big Narrows, Poudre Canyon.  
3. Sheep Creek, Colorado-Wyoming line.

#### Coal

I. Traces at base of Big Muddy sandstone of upper Dakota Formation.

1. Soldier Canyon  
2. Spring Canyon  
3. Water-main tunnel south of Bingham Hill

II. Workable strata in Laramie Formation in eastern part of county.

1. Mined at Indian Spring Coal Mine.

III. Coally hydrocarbon in Niobrara Formation, see Gilsonite.

Dolomite, many zones of the Ingleside limestone are dolomitic.

Epidote, more common in the Long's Gulch area than elsewhere in the county. It is massive and in well defined crystals, in small seams and cavities.

I. Large crystals with white quartz and hematite

1. Long's Gulch

II. Massive compact

1. Long's Gulch  
2. Dale Creek

III. Crystalline, granular masses.

1. Long's Gulch.
2. Sheep Creek, north of Campton's.

IV. With calcite and hematite

1. Sheep Creek, north of Campton's.

Feldspars

The feldspars are found throughout the metamorphic areas of the county in pegmatites and granitic intrusives. Crystals of the mixed feldspars are several feet long and often well formed, though more common as graphic granite. See orthoclase, plagioclase, microperthite.

Flint

- I. Concretions in lower Ingleside limestone.
  1. Haygood and Boxelder Canyons.
- II. Large grey concretions, 200 pounds and over, in Morrison Formation.
  1. Campbell Spring Draw. North Poudre Ditch.
- III. Gravel boulders in Tertiary gravels
  1. Round Butte
- IV. Banded concretionary masses
  1. Round Butte gravels.

Fluorite

- I. Purple cleavable masses.
  1. Three miles northwest of Virginia Dale
  2. North Fork Thompson
  3. Two miles west of Forestry Lodge at Pingree Park



II. Dark purple opaque in small cavities in granitic rocks.

1. Poudre Canyon 1 mile below Falls.
2. North Fork Thompson and Redstone Divide.

III. Green cleavage masses.

1. Three miles northwest of Virginia Dale.

IV. Yellow, white and transparent

1. Northwest of Virginia Dale (3 miles)

Garnet, is a very common mineral throughout the metamorphics. In the section east of the North Poudre River and South of Log Cabin the gneisses and schists are especially productive, while they are common along the pegmatite contacts and often in pegmatite. The schists near the Forks at the Fort Collins Water-works contain several varieties.

I. Brown, trapezohedron and dodecahedron

1. North Fork Thompson 2 miles above Forks ( $4\frac{1}{2}$  inches in diameter)

II. Brown, trapezohedron only.

1. Poudre Canyon pegmatite 8 miles above Ted's place (2 inches in diameter)
2. Yauger's Place.

III. Massive, light brown in quartzite schist.

1. Mt. Vernon, 4 miles west of Fort Collins.
2. Water-works Hill Poudre Canyon (5 inch dodecahedral face).
3. North side river at Water-works and along North Fork of Poudre.

IV. Massive green and brown.

1. Pingree Park near Raymond's Saw-mill.
2. Water-works Hill, Poudre Canyon.
3. Water-main tunnel at Stearley's.

V. Small green grains in calcite

1. Pingree Park
2. Stove Prairie Landing ( $\frac{1}{2}$  mile below) in Poudre Canyon.

- 3. Water-works Hill
- 4. Water-main tunnel at Stearley's
- VI. Red trapezohedron in green muscovite
  - 1. North slope of Crystal Mountain
- V. Light brown dodecahedron (well formed)
  - 1. Pingree Park
- VI. Brown, with chalcopyrite and pyrrhotite.
  - 1. Empire Copper Mine
- VII. Compact with hornblende
  - 1. Waterworks Hill
  - 2. South-west of Ingleside
- VIII. Sand
  - 1. Rhodolite, in the wash of gulches southwest of Ingleside. Some sand is pure garnet.

Gilsonite; see bitumen

#### Gold

- I. The Manhattan District has produced in limited quantities.
- II. Bug-holes in granite
  - 1. Buckhorn
- III. Specimens of free and combined gold have been brought in and have been reported as from the Big South Poudre.

Graphite, In gneiss in Long's Gulch. (Flakey and micaceous).

#### Gypsum

The gypsum producing zone of the Lykins Formations extends from west of Loveland to the North Boxelder District and beds are 50 ft. thick and over.

I. Alabaster, white, compact, hard

1. Boxelder, north of Table Mountain.
2. East of Pinon Pines
3. Owl Canyon

II. Alabaster, gray compact as mined for cement and plaster.

1. Loveland Plaster Mill.
2. Northwest of Laporte (1 mile)
3. East of Goodwin's Ranch on Sand Creek
4. West of Greenacre's Ranch
5. Campbell Springs Draw north of Pinon Pines

III. Massive pink softer than that referred to as alabaster.

1. Campbell Spring Draw
2. Owl Canyon
3. East of Pinon Pines
4. Boxelder and Sand Creek
5. West of Loveland and 1 mile south of Plaster Mill
6. Loveland Plaster Mill Quarry.

IV. Selenite; distinct prismatic crystals are found in massive gypsum of the Lykins Formation, and often enclosed in large selenite masses of same deposits. The Niobrara shales inclose isolated, well formed crystals, often several inches in length.

A Niobrara horizon of marcasite concretions shows spherical masses replacing the sulfide concretions as alteration products of oxidation of the sulfides in the presence of calcareous material.

1. Small prismatic crystals in cavities and fissures in quarries of Loveland Plaster Mill (transparent to white).
2. Large sheets, many showing twinning (transparent to white) 1 mile south of Loveland Plaster Mill.
3. Large sheets, drab, due to colloidal clay.
4. Large sheets, pink to red, containing hematite and clay.
5. Large transparent masses with twinning, Campbell Spring Draw.

V.     **Satin Spar**

Occurs in red shales and clays above massive gypsum of Lykins Formation, in narrow veins usually less than 2 inches wide.

1. Owl Canyon
2. East of Pinon Pines
3. South side of draw, east of Pinon Pines, fibers are found 18 inches in length.
4. Small seams are noted in Niobrara shales in many places.

**Hematite**

- I.     Massive, south slope of Crystal Mountain.
- II.    Micaceous with epidote, Long's Gulch.
- III.   Seams in Fountain and Ingleside Formations, 10 miles west of Loveland south of Park Road.
- IV.    Seams in granite, Stonewall Canyon north of Forks Hotel, North Poudre.
- V.     Earthy, common in Fountain and Lykin Formation.
- VI.    Pseudomorphs after Magnetite are common in the pegmatites and granites.
  1. In pegmatites at Poudre Falls.
  2. In pegmatites near Chamber's Lake.
  3.     "             "             east of Lory Hi.
  4.     "             "             along road north of Crystal Mountain.
  5. Spring Creek Ranch, Upper Elkhorn Creek.

Hornblende, is the most common mineral of the dark colored metamorphics, while most of the schists of the metamorphics are so colored. The crystals vary from fine compact schist to crystals two inches in diameter.

- I.     Fine schist nearly pure hornblende
  1. Rist Canyon
  2. Dale Creek
  3. Hills Gulch
  4. Big South Poudre River

II. Coarse gneissoid

1. Poudre Canyon 1 mile above Water-works.
2. Empire Copper Mine
3. Pingree Park

III. Coarse schist

1. Empire Copper Mine
2. Long's Gulch
3. Big South Poudre (1 mile above forks)
4. Manhattan
5. Water-works, Poudre Canyon
6. Dale Creek
7. Yauger's Cabins, Poudre Canyon.

IV. Coarse brown-black

1. Ingleside Gulch in wash.

V. Schist with biotite

1. Big South Poudre (fine plated)
2. Thompson Canyon
3. Buckhorn

Hydrocarbon, undetermined, from Niobrara Strata  
See Bitumen

Hypersthene

I. With hornblende

1. Ingleside wash.
2. Soldier Canyon wash.

Limonite

I. Massive

1. Crystal Mountain

II. Cavity and seam fillings are common near the  
sedimentary-metamorphic contact in both materials.

III. Pseudomorph after marcasite.

1. Common along the Benton-Niobrara contact and  
in the marcasite horizon of Niobrara Formation.

IV. Pseudomorph after pyrite in hornblend schist

1. Long's Gulch
2. Rist Canyon (3 miles above mouth)

Magnetite

- I. Grains and well defined octahedral crystals are common in pegmatites and vary in size up to 4 inches in diameter.

1. Poudre Canyon (just above the Narrows)
2. Poudre Falls
3. West of Ingleside
4. Chamber's Lake
5. Crystal Mountain
6. Lory Hi (east of lodge)
7. Poudre Canyon opposite Rainbow Bridge

II. Massive

1. Crystal Mountain
2. Livermore District
3. Elkhorn District

III. Lodestone, with cleavage

Larimer River, northwest of Glendevy.

Malachite

- I. Encrusting masses (thin).

1. Dale Creek, 2 miles south of Virginia Dale.
2. Empire Copper Mine.
3. Ingleside (2 miles west)
4. " (2 miles southwest)
5. Stains have been noted along Poudre Canyon in many places.
6. Thompson Canyon and North Thompson Canyon show stains at many places.
7. Storm Peak section.
8. Redstone-North Thompson divide
9. Sheep Creek, Colorado-Wyoming line.

Manganese minerals

- I. See Manganite  
Pyrolusite  
Psilomelane

II. Manganese dendritic.

1. Common in the limestones and sandstones of the Ingleside Formation.
2. In massive white sandstone; 2 miles northwest of Frank Rodgers' Ranch, 25 miles north of Fort Collins.

Manganite

- I. In limestone caverns
  1. Ingleside Formation in Pinon Pines.

Marcasite

- I. Large crystalline concretions in the Niobrara Formation
  1. West of Round Butte
  2. North from entrance to Campbell Spring Draws
  3. Northwest of F. Rodgers' Ranch
- II. Flat concretions with earthy exterior
  1. Fox Hill Formation, north of Windsor Reservoir. Sec. 27, T 7 N, R 67 W.
  2. Common in Niobrara Formation.

Mexican Onyx

See Calcite

Mica

Muscovite is common in the pegmatites and has been prospected. Large sheets have been secured in Poudre Canyon and it has been shipped from the Buckhorn Mica Mine near Crystal Mountain. See Muscovite and biotite.

Microcline-microperthite

- I. Yellow to gray is found in a pegmatite that extends for several miles north and south just west of the sediments.
  1. Water-works Hill, Poudre Canyon
  2. Rist Canyon
  3. Mill Canyon

4. Long's Gulch
5. West of Soldier Canyon

#### Microperthite

- I. Massive Crystal
  1. Long's Gulch - Rist Canyon Divide.

#### Muscovite

- I. In pegmatite throughout the metamorphics.
  1. Buckhorn Mica Mine
  2. Poudre Canyon 20 miles from Fort Collins
  3. " " 22 " " " "
- II. Schist of very fine texture is common
  1. Thompson Canyon, near Fortis
  2. Long's Gulch
  3. Buckhorn District
  4. Crystal Mountain
- III. Coarse green crystalline
  1. Specimen Mountain north slope.
  2. " " south slope.
  3. Buckhorn Mica Mine.
- IV. In sandstone.
  1. Lower Fountain Formation, west of Horse-tooth Mountain.
- V. Well formed crystals in felsite
  1. Cameron Pass Road, near summit.

Oligoclase, see plagioclase

#### Onyx

- I. White and gray bands
  1. Specimen Mountain



## Opal

- I. Common white
  - 1. Geodes of Specimen Mountain.
  - 2. Amygdules on Joe Wright Creek.
  - 3. Pebbles of Tertiary conglomerate.
- II. Pink
  - 1. Specimen Mountain
- III. Jaspopal, yellow-brown-green.
  - 1. Specimen Mountain

## Orthoclase

- I. Pink crystalline masses from pegmatites containing microcline flakes.
  - 1. Large cleavage masses, 20 miles from Fort Collins in Poudre Canyon
  - 2. North Fork Thompson, Storm Peak Road.
  - 3. Thompson Canyon, 1 mile above Forks.
  - 4. Pingree Park.
  - 5. Soldier Canyon.
  - 6. Buckhorn.
  - 7. Empire Copper Mine,  $\frac{1}{2}$  mile west.
  - 8. Dry Thompson Creek.
- II. Enclosing parallel quartz crystals.
  - 1.  $\frac{1}{4}$  mile north of Rainbow Bridge, Poudre.
  - 2. Long's Draw.

## Pennenite

- I. Pseudo-crystalline in quartz
  - 1. Buckhorn, 4 miles above Masonville.
  - 2.  $\frac{1}{4}$  mile below Empire Copper Mine.

II. Massive, with andalusite

1. Near Copper Mine.

III. Schistose, - in great thickness.

1. Buckhorn canyon
2. Thompson Canyon, (Lower portion of canyon).

Petrified Wood, see Quartz

Petroleum

Producing wells on Wellington and Fort Collins show a paraffin base to the local oil. (3500 acres).

Petroleum residue

1. Dakota Formation east of Owl Canyon.

Phosphorite

I. White fibrous

1. Near Glendevy, Laramie River.

Plagioclase

I. Variety oligoclase, pink-gray, striated.

1. Long's Gulch.
2. Just above Big Narrows, Poudre Canyon.

II. White, Striated

1. Water-works Hill, with biotite and pyroxene.
2. Mill Canyon.

Psilomelane

I. Botryoidal coatings in limestone caverns

1. Pinon Pines

II. Compact concretions

1. W. Lindenmier Ranch 25 miles north of Fort Collins.

III. In recent gravels

1. East of Soldier Canyon (south of road).

IV. See Manganese dendrites.

Pyrite

I. In Hornblende Schist, well formed cubes.

1. Rist Canyon.

II. In fossil limestone, well formed cubes.

1. Benton-Niobrara contact west of Round Butte

Pyrolusite

I. In limestone caverns

1. Pinon Pines

II. Compact concretions with psilomelane

1. W. Lindenmier Ranch

III. Wad, soft earthy brown.

1. Pinon Pine limestone quarries.

Pyroxene, common in many of the gneisses.

I. Green cleavage masses.

1. Water-works Hill, Poudre Canyon.
2. Rist Canyon.
3. Long's Gulch.

II. Minute crystals in basic dykes throughout the lower metamorphics and in the extrusives at Chamber's Lake.

Pyrrhotite.

I. Lenticular masses inclosed in hornblende schist with chalcopyrite.

1. Empire Copper Mine.

## Quartz

- I. Amethyst, large crystals, up to 5 inches by 3 inches in collapsed large geodes in granite.
  1. Log Cabin district.
  2. In seams and caverns in granite on upper Elkhorn Creek.
- II. Chalcedony
  1. Onyx and agates as cavity fillings on Specimen Mountain.
  2. Amygdaloidal in basic lavas on Joe Wright Creek.
  3. In Tertiary gravels at Round Butte, the northeastern portion of the county and Boxelder Creek.
  4. Green, as cavity lining, Specimen Mountain.
- III. Chert containing Mississippian fossils is found in gravels of the lower Fountain Formation and again in Tertiary gravels at Round Butte. As cherty limestone in Boxelder and Haygood Canyons.

See Chert.
- IV. Ferruginous quartz, in crystalline masses deposited in limestone caverns of Ingleside Formation at Pinon Pines.
- V. Flint, see flint.
- VI. Jasper.
  1. Green and red blotched at Specimen Mountain.
  2. Tertiary gravels in northeastern part of county.
  3. Basal Dakota conglomerate as petrified wood, Bingham Hill.
  4. Fragmentary jasperized wood in recent gravels.

5. Near Bulger.

6. Coal Mine north of Wellington.

VII. Rock Crystal

1. Crystal Mountain, in the rhyolite lithophysae with topaz.

2. Pinon Pine, with ferruginous quartz.

VIII. Rose Quartz

Massive in coarse pegmatites.

1. Crystal Mountain.

2. Thompson Canyon near Forks.

3. Long's Gulch.

IX. Smoky

1. On Elkhorn Creek near Log Cabin.

2. West of Red Feather Lakes associated with amethyst.

X. Silicified wood; common in basal Dakota conglomerate and as boulders in gravels in north-eastern part of county.

1. Table Mountain, Sand Creek.

2. Bingham Hill.

3. W. Lindenmier Ranch 25 miles north of Fort Collins.

XI. Translucent white is very common in pegmatites and in large isolated masses throughout the granites especially in north central area of the county.

1. Virginia Dale north to State Line.

2. Long's Gulch-Rist Canyon Divide.

3. Top of Crystal Mountain.

4. Rainbow Bridge, Poudre Canyon.

XII. White crystals

1. Long's Gulch

Quartzite.

I. Many of the schists are nearly pure quartzite

1. Road Tunnel, Poudre Canyon.
2. Big Narrows, Poudre Canyon.
3. Lower Thompson Canyon.
4. Buckhorn Canyon.

II. With garnet.

1. Mt. Vernon.
2. Water-works Hill.

Selenite, See Gypsum.

Serpentine

I. Massive green.

1. Greeley-Poudre Irrigation Tunnel.
2. Stearley's Cabins, water-main tunnel, with calcite and hornblende.

Sillimanite

I. Common in the mica schists in the Thompson Canyon district and north through the Buckhorn section to the Poudre.

1. Thompson Canyon.
2. North Thompson Canyon.
3. Rist Canyon.

Staurolite

I. In mica (muscovite) schist.

1. Milner Mountain.
2. Fish Creek, Buckhorn.
3. Thompson Canyon.

Titanite, grains in intrusives in Lower Thompson Canyon.

Topaz. Clear glassy and light pink.

I. In rhyolite lithophysae, with rock crystal.

1. Specimen Mountain

## Tourmaline

Black tourmaline is common throughout the southern half of the metamorphics, especially in the Thompson River drainage area but is quite rare in the lower Poudre area.

Distinct well formed crystals are usually confined to the pegmatites, while small radiating groups and isolated individuals are common in the muscovite and biotite-muscovite schists along the pegmatite contacts. Along Fish Creek, South of Crystal Mountain large well formed crystals and crystalline masses are 6 inches in diameter.

- I. Large crystals in pegmatite
  1. Fish Creek, Buckhorn.
  2. Empire Copper Mine; ( $\frac{1}{4}$  mile west).
  3. Lory Hi, (1 mile east.)
  4. Mill Canyon.
  5. Arthur's Rock.
- II. Well formed crystals in quartz, showing terminal faces.
  1. Long's Gulch.
  2. Mill Canyon.
  3. Buckhorn, 1 mile west of Eagle Rock.
- III. Small well formed needle crystals in radiating groups in mica schist.
  1. Mont Rose Inn, Thompson Canyon.
  2. North slope Crystal Mountain.
  3. Storm Peak Road north of Forks Hotel, Thompson Canyon.
  4. Thompson Canyon, 1 mile above Forks.
  5. Arthur's Rock.