Section E. from Swan - Clearwater river divide. Starting from the lake on Holland Creek, at the foot of Gordon pass, the strata dip NW. at an average angle of 30°. At the base of the section, greenish siliceous beds, with occasional beds of bluish and buff weathering limestone, continue to the summit of the ridge on the N. side. On the S. side, massive beds of alternating green and reddish siliceous beds continue eastward for some distance, when they are succeeded by a great belt of reddish sandstones, alternating with more or less buff-colored calcareous beds.

A rough estimate of the thickness of the strata up to the reddish beds is 6,000 ft.; of the reddish siliceous and green beds, 7,000 ft.; of the red beds, 3,000 to 4,000 ft. Further east
Swan River—Elephantine (cont.)
on the ridge, of which Leopargout Mt. is the southern termination, the
massive gray limestone of the
Cambrian and Carboniferous may be
seen.

So far as can be determined from
the hasty reconnaissance made, the
silurian and calcareous beds which
are west of Leopargout Mt. & extend
over to Flathead Lake, represent the
Belt Terrane as developed in the
Belt Mts. This however needs
corroboration, as apparently the
Belt Terrane as exposed in the
Lewiston-Clark Fork pass section is
entirely beneath the series of silurian
and calcareous beds of the Missoula
Range, and between the Char Wat
and Swan river valleys and the
limacies on the eastern front of the range.

This is one of the great
sections of the Rocky Mts. that
remain undecided in detail, and it is exceedingly desirable that the systematic investigation should be taken up at as early a date as practicable. The first essential requisite is to begin in the vicinity of Skagway or the ridge to the north and work westward, following down through the series from some known horizon that has been palaeontologically determined.

**Glacial phenomena.** Glaciers of considerable size appear to have descended the eastern slope of the Mission Range and the western slope of the range east of Swan and Clearwater rivers. Several glacial lakes exist on the slopes and also in the valley of the Clearwater. The valley of the Swan river appears to have been very unevenly eroded, for as far as seen, no glacial lakes exist. East of
The Swan River range, looking over into the rocky valley (?). Two or more small glacial lakes can be seen from one point.
July 13th 05

West slope of Swan range, south of Holland Peak on ridge Tertiary summit of range.

Base - str. N. 300' W. 11435 N.

a) Light grey phyllite

b) Siliceous bound beds 1-2 ft thick with parting of siliceous shale. At

irregular intervals layers of coals with numerous

vugs in the lower part, flattened nodules & stringers parallel
to the bedding. Some

of the shaly beds are one

or two feet thick & more

on less argillaceous or
calcareous. On weathered

surface the calcareous beds weather buff & dull

grey.
On the base 600 feet in thickness was estimated from the occurrence of concretions. At 1067 feet a band of grey shale, 35 feet thick, occurs. 1100.

Silicified calcaraceous layers from 1/2 to 2 feet thick, the calcaraceous matter in the form of irregular nodules embedded in siliceous matrix. Sometimes one, then the other predominates and together fuse silicious or of amebeaceous form - occur. Occasionally the nodules of form are small, very irregular in size and almost make up the rock.

760.
164 - 200 = 36  
164  150,  180  
820.  3  56.  
136  
956  70  60.  
18.  65.  
36  164  
210.
2. Banded chalk beds with little calcareous matter.

3. Gray, compact, more or less silicious limy with thin chest layer, irregular nodules that come hand in hand to the calcareous nodules in it.

5. Banded chalk

7. Limestone similar to

9. Banded chalk - dark grey

10. Dark grey, rough, silicious intercalations between layers 1-5/16" thickness at 56 feet a band of cryptocrystalline in large
manner seen to extend this about 6 feet of

105.

A. Dark blue black

109.

B. Grey thin bedded

52.

C. Grey thin bedded

E. Grey thin bedded

massive drupte gray brack at base 3 feet

thick with pelizens

195.

F. Grey thin bedded

through bedded

(If snow slue in weathering

while I running at 10

feet into a more shaly

line.)
in thin layers + rarely arenaceous layers 6-7
15-20 thick. 410.
Total of 9

Resume.
The great band one's
of grey chert beds +
which grey limestones
of the Holland Peak
section, from range
may be called the
Holland form terrace.
It is made up as follows

dark
1. (a) grey siliceous banded
beds
(b) Siliceous + clay bands
these alternating 960
(1) Banded chart beds
a. Grey silicious lam. 175
b. Banded chart beds 65
c. Lemaitre 80
d. Banded chart beds 70
Total of (1) 2660

(2)
a. Grey rough lam. 105
b. Black chart beds 4
b. Grey lam. 109
c. Black grey thin-beded chart band 5.2
d. Lam. + chart beds alternated 185
(4) Grey lam. Thin
b. Banded + shaly 845
(5) Black chart 23
b. Chart beds + thin layers of fine that become less and less frequent towards the base
Total of (2) 992

23 25
<table>
<thead>
<tr>
<th></th>
<th>mainland</th>
<th>2660</th>
</tr>
</thead>
<tbody>
<tr>
<td>2</td>
<td>calcarea</td>
<td>2325</td>
</tr>
<tr>
<td></td>
<td></td>
<td>4985</td>
</tr>
</tbody>
</table>

The two divisions are rather arbitrary probably would not work good at any distance.

Red and redstone above.

See Camp Creek section for Red beds, etc. to cola.
Blocks of Algonkian limestone below crest of Swan range on east side. Each of Holland Lake, Lewis & Clarke Forest Reserve, Montana.

In W
July/05

M. Callen located rocks.

(2 Negatives)
Swan range
July 13/05

The Swan range south and north of Holland Peak is famed of Alaskan rocks dipping east. Holland Peak is the lower limestone of the Alaskan section of the region. The limestone is highly silicous and resistant quite as well as much of the overlying quartzite and sandstone beds. The section from the foot of the Flathead west to the Swan range is about as follows:

- Carboniferous
- Alaskan

The Alaskan rocks measure over 15,000 feet in thickness.
Cryptozoan — occurs in large masses. One bed shows a single mass 4 feet thick and seven feet across the base as exposed in the section. The layer is largely made up of the Cryptozoan for fifty feet at more, or all of the exposure at that point.
\[
\begin{array}{c}
14 - 21 = 36 \\
70 - 105 = 17 \\
10 - 3 - 1\frac{1}{2} = 12.5 \\
8.2 - 4.3 = 3.9
\end{array}
\]
Cambrid sect.  
July 2\textsuperscript{1}\textsuperscript{st} 05

Base of sect. begins on saddle beneath limestone cliff half way between Jordan Mtn. summit and Cambrid Peak. and extends E. N. E. along the ridge between Young's Creek and Jordan Creek.

Sketch:

\begin{itemize}
  \item [\textbf{Algonquin}]
  \item [\textbf{Washoe Tonal}]
  \item [\textbf{Flathead Sandstone}]
\end{itemize}

\textbf{Flathead Sandstone:}
A grey sandstone in thick beds some of which are a fine conglomerate. Gravel pebbles up to 1/4" in diameter.
July 21/04.

Their bedded greenish and brown sandstone with shaly sandstone partings, Amblisid borings & trails, mud cracks & ripple marks.

Total Flathead Junction 125 ft.

Woolsey shale:

a. Greenish & bluish grey argillaceous shale with

Strike E. 1/2 W. Dip. 45° N.

Irregularly interbedded sandy shale & thin layers of compact grey sandstone. At 82 feet up a thin layer of sandstone contains fragments of bacularide & the shale above quite a fauna (Horizon of Dec. 25. of C. Devonian Sandan Creek). See collection there in list.
\[ \frac{250}{5} = 50 \]

\[ \frac{140}{2.4} = \frac{140}{2.4} \]

\[ = \frac{164}{112} \]

3.

\[ \frac{15}{2.12} = \frac{15}{2.12} \]

\[ = \frac{30}{2.12} \]

\[ \frac{11}{2.55} = \frac{11}{2.55} \]

\[ = \frac{11}{2.55} \]
Hyolithes + Ptychoparia occur in several bands of greenish shale between\nmud sands layers.

b) Layers of in profile, grey\nweathering blue, limestone
with bands of "greenish\nshale between them.

Iphisea - Ophicingulella) 00.
like A14, rotundates. Frag-
ments of trilobites occur
in the sheet lime\nterbedded shale.

21.

c) Greenish shale\nweathering lighter\ngreen

d) Chocolate or purple
argil + sandy shales.
A strong fauna
appear in c + near
later Woodsey shales.
3) Meagher limestone
Thin bedded grey arenaceous limestone becoming greyer a little above the base. At 45 feet the beds become more massive but break down into thin layers on weathering. Fragments of fossils occur.

4) Park shale,
Green to gray argillaceous and arenaceous shale.
Families
Phychozona
Asaphicna wheeli

Iphidena

The Fort shale is feet thick on the S. fork of the Deer Trail.

Pilgrim limestone

Thin layers of thin greyforn.

Thin John marine layers when washed, broken down by weathering. Traces of fossils.

Iphis reaches 80' near top.

Dry creek shale.

Shale green argillaceous with a few layers of limestone interbedded.

2) Sand

(3) Three feet thick.

Thickens.

Families: Iphidena

Iphidena

Hyalithes
\[
\begin{array}{c}
\frac{32}{75} - 82 \\
\frac{185}{30} - 70 \\
\frac{215}{37} - 330 \\
\frac{74}{5} - 165 \\
\frac{370}{60} - 27 \\
\frac{60}{430} - 192 \\
\end{array}
\]
Acarii

7. a) Thin banded bluish grey limestone, with many ameloid forings and trails.

215

Sh. E. T. 20. Ely 41°N.

8) Dark grey limestone in layers 3 or 5 8" thick. Arctic in some layers, A with ameloid forings and trails. 190

9) Light grey limestone similar to 8.

Cutoff at 430 feet by a twist fault in the beds.
Mission Range. 19-2-00

E. slope from Mr. McDonald. The eastern slope of Mr. McDonald is very steep. Several glacial lakes occur; one, a little to the NE, occupying a deep cleft in the sandstone rocks. Two other small lakes are shown on the slopes to the N. of the large one. The rocks show glacial grooving and polishing, and give evidence that a glacier of considerable dimensions extended to the NE out into the valley of Swan river. At the present time there are two or three small glaciers on the E. side of the ridge, a little to the S. of Mr. McDonald. Also a small glacier, showing evidence on the S.E. slope of the peak. The photographs taken may show the encroachment.
Geological structure. Mt. McDonald and the Mission range in its vicinity consist of buff sandstone, with occasional bands of reddish color, dipping to the eastward. To the north of Mt. McDonald the strata are lying level for a considerable distance, and then turn up to the north.
Algeria
Aug. 9th

Section of Algerian rocks. Reaching the summit of Ravalli Mnt., hence North Pacific by track.

For two miles above Ravalli on the N. P. Jecker creek cuts thru a cloude of compact growth grey quartzite sandstone.

On the rock ridge where the section begins the dip is N. E. toward the Missouri range.

The section curves the painfully in an Easterly direction towards the Missouri range south of Mt. McDanel.
\[
\begin{align*}
820 \div 5 &= 164 \text{ rem } 0 \\
4100 \div 5 &= 820 \text{ rem } 0 \\
4445 \div 5 &= 889 \text{ rem } 0 \\
200 \div 3 &= 66 \text{ rem } 2 \\
223 \div 3 &= 74 \text{ rem } 1 \\
114 \div 3 &= 38 \text{ rem } 0 \\
180 \div 3 &= 60 \text{ rem } 0 \\
940 \div 3 &= 313 \text{ rem } 1 \\
120 \div 3 &= 40 \text{ rem } 0 \\
\end{align*}
\]
1. Greenish grey fine grained, cross-beded quartzitic sandstone in layers 4\textsuperscript{th} to 6\textsuperscript{th} thick with 4\textsuperscript{th} to 6\textsuperscript{th} thick shale beds occasionally. Strike N. 45\textsuperscript{th} W. 10\textsuperscript{th}. 45\textsuperscript{th} E. N. E.

4645 ft.

2. Sandstone a little coarser more grey in color.

1060 ft.

2. Greenish grey color at bed bottom more of greenish color alone. Somewhat banded in shades of greenish greyish greenish grey. The beds are quartzitic. Sandstone much like those below with at 260 feet at the greenish color red aggregate.
232

514

220

296

2516

1500

110

550

20

15

37

3
with occasional bands

At 1160 feet up the beds are more quartzitic.

45° W

2550.

3 At this point the greenish chert and shaly beds appear and on
620 feet all the beds are calcareous chert and gray with ophiolite.
cherty layers in the same manner as at the base of the Holland
Peak limestone in the Laramie range measured 3660 feet at exposed

The shale beds of the Black Fork are calcareous
Shale. Mineral Hill
are represented by the pubhsh sandstones
This section refers to the gray beds associated with them. The sediments are slightly corru-
gated in more massive beds.

**Summary**

\[
\begin{array}{c}
1. \ a \\
2. \ \frac{a}{b} \\
3. \ -
\end{array}
\]

\[
\begin{array}{c}
4645. \\
1060. \\
2550. \\
8.255 \\
3.650
\end{array}
\]
Geologic Structures

Rocky Mt. Ford Creek, west of Augusta Mnt.

Ford Creek cuts through the front range.

E. S. valley

Faults

Folded

Blocks of strata face north and the thin red beds of the Cretaceous are folded and faulted in true ant-thrust structure.

Aug. 30/04
July 29/08


Recto: Begins in purple colored pillow beds well of on the slope towards mineral mountain, beyond distorted rocks.

Verso: Shaly + sized very fine grained pasture tinted sandstones in thin layers + shaly beds. No deformed here.
At 70 feet a bed of diabase in intruded forming a sill. The diabase is about 20 feet thick. Thickness exclusive of the diabase indicated 610.

Greenish tinted flannel hand, compactly fine grained sandstones - layers, shaly layers in layers to layers a foot thick or more, ex. N.E. 100 ft.

3) Saprist black beds, alternating similar to proceeding with alternating greenish beds.

4) Greenish grey fine grained beds that break clean with shaly + thin layers. Weather green-buff grey.

At 230 feet all massive greenish grey with weathering layers careen. 27.50
45 - 50 - 66

135
695
113
808

225
330

360
1500
1800
1300

-260
-100
-210

1800
1517

2100
1) Gray siliceous beds with a small amount of calcareous matter as shown in the weathering to gray stuff. At 205 feet 62 a little sand and 28 feet their occur. At 305 ft. - the siliceous beds become more calcareous and bonded. At 810 the gray sill weathering contably siliceous being in places thicker layers begin to show embedded layers of granular gray weathering limestone irregular nodules in the siliceous layer. At 1520 feet gray limestone layers with irregular siliceous stringer nodules weathered half a lane.
prominent feature for quite a stretch of
bluff.

At 1685 elevation of Cryptogam in 15th of
October, occurs a layer of gray siliceous
limestone.

This bedded, chalky &
grey weathering more
than shaly limestone.

b. Gray limestone with
Cryptogam, dolomite
layers & pellicia
layers with megamen
structures & cokels of
grey limestone. The pellicia
making weather half
the limestone, varying
at 12 feet of limestone
on one nearly white limestone.
24
14 0
36 0
11 5
4 5
1 1 5
43 5 0
1 3 1 0
6 6 0
with occasional layers of lime sandstone above
the section. At 445
up a bed of greyish-grey
marl 2 feet thick
with fine, large
crystals two feet thick
in diameter. Another similar
bed occurs 12 feet higher

The upper 60 feet is
largely formed of
Grey Whitish Limestone
The height is about 1,700 ft.

4. Calcareous chalk with
bands of greenish
rarely siliceous.

At 15 Sep. a

5. Gray limestone, calcite, calcicrete
etc. Light greyish brown
in layers in the first 10 ft at 189 ft. The alternating shaly bed and layering give way to gray lime.
Alternating with impure dark gray buff weathering lime.
At 580 the shaly beds predominate alternating with thin layers of gray lime and an decomposed bright green layer. Mean
the top a faint dolitic lime. layer occurs 1310.

6. Tournai beds.
Fine sandy layers pinkish to
dull red with coarse grains
of sand than shale.
Grayish, weathering buff slightly
calcareous fine grained sand.
The lower half has more
reddish beds & the upper
half white half or yellowsih
beds.

The above section is below
the red beds which con-
tinue from here to the
continental divide the
same as the bench
Gree K section-

Total thickness above
purple beds

1885
520
810
155
1310
155

4805

Below Birketree

1 915 purple + green
2 615 siliceous white
3 585
4 225

2156
East side Pole Creek, at frame, 2.8 mi above 2.34 Elev. Cherry Creek, Three Forks Road, Montana 1926

Very well gravel in wide canyon to springs.

Pole creek
2-3 Sept. section on Billy Creek, above Cherry Creek 1926 along road about 9 mi. south of Stripes section.
15 August 1929  
Pale Creek, Montana  
(Page 1  
(Measured)

(Base)  
Sporadic contact not seen.  

Quartzite  
Slight bed exposed, consists of a conglomeric layer (6" exposed) of white sandstone, 
rather soft, containing scattered clay quartz 
pebbles up to about 3" in diameter.  
These pebbles are often sharply 
angular, at other times being some- 
what rounded.

Then follow, about 2' of soft, 
argillaceous sandstone, slightly 
finer in color.

Gradually, the sandstone becomes 
more quartzitic and heavier bedded.  
At about 216' up, 216' beds occur and 
these are followed by about 12' of 
purple sandstone (more so).

Thick and thin, hard and soft white 
and purple beds alternate all the way to 
the top.  The uppermost beds appear 
to be the hardest (most vitreous).

The lower part of this bed is 
consisted of

Shale  
As soon as any material appears, it consists of the usual yellowish.
not measured. Keep black diplomatic cover, Consulate.

[See earlier section, 1926]
fucoida, micaceous shale without fossils. Thin beds of sandstone give sufficient resistance so that they form bands of outcrop.

The upper part of the series as measured is covered in the stream bottom, and consequently may be soft shale belonging to the next unit.

Upper portion becomes sufficiently sandy, and also increasingly calcareous, that it forms low cliffs.

At the cliff top a slope begins. It consists of thin-beded limestones, that limestone are irregular sheets and lumps with shaly partings. Fossils abundant.

Rubbly

27'
Drapage

A sudden change to soft black
A. tannish-brown, which contains smooth oval
Black shale, lenticular concretions with Agnatic

30'
Ag.

Upper part of series becomes
Limestone smooth, black, interbedded limestone
with some good fossils and many poorly preserved, all in shaly partings.
South Boulder River, Jefferson or Tobacco Root Range, Montana.

The section is not well exposed in its upper beds, except high up on the range to the west of the river.

Peale's mapping appears to be correct, except that too much space is assigned to the Flathead sandstones and shales. Note made on upstream sections.

---

The basal sandstone is nowhere exposed, either here or on Mill Creek on the western side of the range, and therefore it is futile to assume that it consists of lenticular, perhaps more shale beds than usual. At any rate its thickness cannot exceed 30 ft according to the interval between the quiesces and the underlying exposed beds.

The first beds exposed consist of irregular, thin bedded, very argillaceous sandstones, brown in color. No fossils occur, except one little fragment. Next follows a concealed interval in which there should be somewhat similar beds that gradually become more calcareous. This interval in lime content most likely occurs from outcrop above region. Additional "mudstones" ferricelli shales, most grade into muddy limestone.
an increase in the number of clumps of pure limestone rather
than by a greater abundance of widely distributed calcite.

When the beds next arise, they
consist of irregularly bedded limestones
that form low, rather interrupted cliffs. These limestones are quite
irregularly bedded and consist of
masses of blue limestone separated
by or interwoven among yellow or
horny argillaceous and sandy
material.

Another concealed interval which
is expressed topographically as
a rather sharp curve, apparently
consists of shale, or thin-bedded
argillaceous limestones.

The next in sequence is a thin-
bedded limestone that appears yellow
on the outcrop, mainly due to the
staining on the weathered joints.
This bed contains much argillaceous
limestone, but other layers are
sandy, edgeness (almost) and
public conglomerate. In the
softer beds fossils are abundant.
belonging apparently to the Cephalopoda zone, but with Camarodes, etc.

A large collection made here and also at the down-wires outcrop,
apparently from the same zone.

Immediately above these thin-bedded limestones and usually forming the broader portions of the cliff in which both beds are exposed is a massive limestone blue mottled with darker spots: Dolomite.

Sample. A very small portion is mottled. Practically all of it consists of dolomite, cross-bedded. A little chert forms on the surfaces.

Jefferson.

# 392 - From lower outcrop in middle Cambrian, same as loc. 150 - Peale’s 1857.
Camp Creek Section
McCutney Range, east of Melrose
Montana

As a whole, this group is of the usual character. It consists essentially of beds of varying degrees of massiveness, all dipping at much the same angle as the overlying Cambrian. Where thin these beds are often much contorted. These beds are usually dark colored with much purple and some green. Many are gray to brown.

Numerous gravity veins occur throughout these beds.

Ten or more feet of the groupes below the Cambrian Limestone are very much weathered. The upper ten feet are quite soft, having been almost reduced to granular form prior to the deposition of the Cambrian.

The actual line of contact is a very smooth surface that deflects from a plane hardly more than 6° in a hundred feet, at least where it was observed which outcrop exposes several hundred feet of the unconformity. However, after Cambrian faulting has somewhat obscured this and a more relief than is indicated may occur at places.
The first few inches above the contact (2'-6') consists of angular quartz blocks from the veins in the underlying greis, in a matrix of sand of quartzite. At some point:

- Photographs: #3-10, and #4-1. Veins, greisses, and contacts. 2, 3, views of contact and fault. 2 is an attempt to photograph the underside of the lowest Cambrian layer. 4-5 views of a larger portion of the contact. All the views made on slanting surfaces and bright quartzite and consequently may not show well, particularly in perspective.

places this quartz is scarce, and then the smooth quartzite comes directly on to the contact.

The first bed, including the basal conglomerate, is a massive quartzite layer, with shaly partings here and there. Most, if not all, of this rock is a whitish, reddish, hard quartzite, with the peculiar soft iron globules in some layers, all weathering to brown, as these flat iron partings are not so much shaly as softer, apparently arkosic, sandstone.
Three-beded quartzites between thicker soft sandstones which are deep purple or yellow to olive. Here and there the usual grayish shale partings occur, and occasionally the purple sandstones become shales just which sand-filled cracks abound. Only a little opinion appears.

Chisel forming quantities of milk-white vitreous, with thick sandstone partings. The lower are more the soft, sugary yellowish sandstones, the upper 3' are much the same, except a little more vitreous. Some surfaces show fusoidal markings, all rather indistinct.

A sill, varying slightly in thickness.

Massive sandstones with beds of 1'6" purple cross-beded, vitreous quartzite, containing angular quartz pebbles up to 1/2'.

Blue thin papery shales, contorted by folding, slightly. Rock cemented.
araceous, micaceous and pyroclastic.

At 17' 6" up a 2½' sill occurs, usually near these sills the shale is taked, to a yellow or brown color. At the upper limit of the shale beneath the third sill, considerable guano, pyrite and chalcopyrite occur in quartz veins, and these have been considerably prospected, which would indicate that values occur locally.

Shale

Shale. Reddish sandy shale at the base, apparently a till fine-grained, soft dark shale, perhaps for the most part, which would account for the fact that it is covered.

Upper part rather lining, apparently. If so, it also is siliceous with considerable chert and the limestone dolomite appears to break into small cubic blocks.

Cliff-forming limestone. Marlire reddened sandy dolomitic limestone, into which many small caves and
channels are weathered.
The upper and lower portions are
Limestone thinner bedded, and some is
cross-bedded

Thin-bedded infine limestones. Mostly
covered with drift, becoming cliff-forming
in its upper part. Most of this series is
black, brown or bluish-green, and
sometimes dolomitic. Much of the more
massive stuff is cross-bedded, and
sometimes contains, usually flat,
mud flakes.
Considerable if it looks as if it is of
algal origin.

Lighter colored bands of variable
and the granular dolomite. Always
cliff-forming. The darker color of
the beds on both sides appears to be
a secondary stain.

Black limestone, dolomite, irregular
bedded with mud flakes, and
marked particularly with white
"worm" tubes, irregular, up to about
on inch long.

The lower portion (circa 30') continues
the massive cliffs, then it becomes
thinner bedded and breaks down into slopes.

This zone is considerably metamorphosed with
a little mineralization.

White limestone. Much the same as
the underlying, about the middle there
is a ½ inch Sandstone and the upper
4 inches are a arenaceous, fumaceous
shale, soft bed.

Fragments of possible fossils show
on the weathered edges, but nothing
identifiable was seen.

The "stone tubs" here are filled
with coarse crystals, that weather
into relief.

The 4' zone looks much like a
soil and loose deposit at a contact.

Massive, black, cliff forming limestone
like that below. A little more
clay appears on some surfaces.

147'

At about 88' ups a sill of dark
igneous rock containing large
flat crystals of possibly amphibole.
Near the top, sandy and slaty layers, thin, appear.
All is dolomitic.

Shale series primarily.

Shales, begins with usual soft, soft muddy material that soon changes into a globigeritic sandstone.
Then follows soft, olive, shales with some yellow, sandy beds and
Micromyia or Westonia (Acardia when mentioned).
Some limestone layers appear. There are usually, purple beds, but some are oolitic. The Secret Canyon
Renateocrinus forma appears here.

A little higher, harder olive, shales carry Ordovician.
Mottled fossils in yellow shales above this point.
The upper portion of this series is sandy beds that are reddish, and then

Very massive dolomitic.
Possibly Big Horn.
12 July 1929

Flathead Pass, Bridger Range, Montana.

Flathead Pass is nearer the northern end of the Bridger Range, than the southern.

In the canyon of Pass creek, the rocks all dip westward at an angle that increases from the west base of the range, reaching practically 90° along the western at this point. The Madison limestone makes the creek with the older beds overlying it to the west. The entire section is therefore overturned to the east.

Several miles north of Pass creek, the beds appear to lie in normal sequence, are much flatter, dipping gently to the northeast, or to it dipping from the north to the south.
12 July
1929

Pass Creek, Bridge Range

Page 2

Three forks shall now found, containing a few fragments of the typical fossils.

Jefferson is a mud of dolomite, 6ft. contains a few fossils.

Gneiss. Jefferson seen, consists of black dolomite.

The contact of the Cambrian with the Jefferson was obscured.

A few feet below this contact, the limestone becomes massive, or at least developed hard beds. It is somewhat conglomeratic and pebbly (pebbles irregular), occasionally carbonaceous are oolitic.

Fossil fragments are abundant in the crystallicic fossils, but all are so broken that scarcely any recognizable specimens may be found. It appears as if this is the Elfinia zone.
Shale

Beneath this marl zone an olive shale with fossil limestone lenses and stringers occurs.

Mottled

These follow the regular mottled beds, at the top of which a number of feet consist of pebble limestone in which the pebbles are well-rounded and usually of bright yellow, orange or red color.

Mottled

Certain portions of this bed have a strong petroleum odor.

Interval nowhere exposed, but soil and stones indicates that it is a calcareous shale with beds of edgecote.

Somewhat above the middle of this interval a dark olive shale of the same appearance as the stephen in Dixon's gulch, occurs but is too poorly exposed to get any
Cliffs forming limestone. Arranged limestone that mingles into stumpy heaps. Upper part somewhat finer and in proportionately, more massive. The fossils were found except warm brackish and the usual sandy hypocone-like tellas.

Triassic sandstone and shales. Forms gullies and consequently is difficult to see. Sandy layers are covered with the usual fucoids.
Flathead: This is the type locality for the Flathead sandstone, as Peale stated.

The contact with the underlying Albertian shale was not obvious. Near the base of the rock is practically a conglomerate in which the largest pebbles do not exceed 2" in diameter. None of the pebbles are completely rounded. The larger ones have their corners rounded off a bit and some of the smaller quartz grains are fairly well rounded.

The whole series is a sandstone, containing much angular quartz matter in the underlying black shale, some beds being more fusaceous, but throughout the whole rather large, usually angular quartz pebbles occur. Some beds are reddish brown, but more than 50% of the formation appears to be a bluish gray.

Blade shale. Shale much jointed, often looking much like coal.

Many limestone nodules occur in this shale, all like the same bed north of the East Gallatin River. Some of the nodules are typical Gallatinapectona, others black limestone concave-cone. A few of these limestone nodules appear to be without structure.
Considerable vitreous quartzite, purple with white streaks, cross-bedded, & the more common "Flathead" type, occurs in the drift in a position that indicates the possibility of its scanning at the top of the sandstone series and beneath the marcescent, sandy shale.