

TRN: 2044742
Phillip Pack

FIELD NOTES



THEME BOOK

06-4434

wide marginal ruled

A PRODUCT OF **Westab** DAYTON 2, OHIO

59¢

MONTH						YEAR
SUNDAY	MONDAY	TUESDAY	WEDNESDAY	THURSDAY	FRIDAY	SATURDAY

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Mormon Mountain, 4/18/70 Same area
as measured section Sunny - Cool - Calm

Fossil trilobites which appear to be
Albipetella were collected in an interval
below the "unconformity". Thickness of
trilobite area is measured as follows:
Unit 21 - begins at "unconformity".

~~13~~
error
Floor 20

measurement slope 10° - formation N16E 45°

Shale, yellow-green, sandy, micaceous,
shaly bedding interspersed with
sandstone stringers. Trilobite fragments
found here - imprint of free cheek and
thorax - and cephalon - scarce.

This measure went off set northward about
100' from top measured section.

(13) Unit 22 - (below 21 - measurement offset
north by about 50 feet, ^{measurement slope 11° N11E}
73 feet - ^{and grey} ~~unit~~ N46SE
Shale, dark green, clay shale, sections
thinly covered in places. Fossil, uniform, a
smooth few fine grained sand stringers near
middle. mica content small or none. Worm
burrows. Fossils not sought here.

(14) Unit 23 - direct measurement 1.0'
Sandstone, Brown, mottled with red,
very fine grained, clear quartz about 90%, remainder
(over)

Unit 23 (cont) - apple green and pale yellow stains - not clearly defined grains - these weather out. Cement partly calcareous. bed 1' thick, hard

(15) Unit 24 - Sandstone, yellow-green, hard, shaly bedded, micaceous, very fine grained & silty. Bedding max. thickness 4 inches. worm burrows. Unit thickness 6' direct measurement

(16) Unit 24 - 4' thick - one bed. Limestone, brown and brown weathering 10% clear angular quartz grains very fine. 1% green mineral - apple to jade green, hard rock.

(17) Unit 25 - 5' thick direct measure - one bed grey & brown mottled, 90% qtz 10% green Very fine-grained - qtz subangular; 5% apple green rounded grains - 5% yellow grains apparently alteration of green. Calcareous cement

(18) Unit 26 - 96' slope measure 16° - find dip about 45. mostly covered but seems to be almost entirely yellow-green shale and shaly sandstone (about 10%), all micaceous. Worm burrows. No great search (cont)

Unit 26 - cont - for trilobites. No trilobite fragments seen on float.

slight change in strike possibly fault
(19) Unit 27 - 0.8' direct - Limestone, tan - (brown weathering) sandy 30% qtz; 10% round ^{dark} green grains, yellow oxidized stains.

(20) Unit 28 - 6.0' direct - Shale, yellow drab small amt very fine mica, little sand, fissil.

(21) Unit 29 - 38' @ 8° slope - partly covered consists of hard yellow-green shaly sandstone and 2 calcareous beds less than 1' each. Faulting suggested. Bottom is a very hard ^{subangular} quartzite yellow-grey sandstone, yellow-brown, 80% clear qtz grains (fine-grained), 19% chocolate brown material interstitial - 1% green mica. - brown apparently an alteration.

(22) Unit 30 - 63' @ 8° - faulted yellow-green rocks - ss, shaly ss, some ~~co~~ med, cm to coarse grained. Bottom - white quartzite off Prospect Mt. rocks. worm tracks in ~~shaly~~ shaly ss.

Franklin Mtn - near Deep Road South
end 7/19/70 - Sunday - Breezy - cool

Lyndon Limestone

Proche Shale

Slope 24°

Unit 1 - covered

Unit 2 - 2.0 to 6.0' - Sand stone, ~~medium~~
yellow green, high in green inclusions, coarse,
10% pebbles (2 inch flat disc) same
material, carbonate cement. One bed

Unit 3 - 8" direct measure - pale green-
grey quartz ss, very hard, carbonate
Cement - (specimen taken)

Unit 4 - Covered - deep alluvial fan

Unit 5 - 39 - 37 - Brown, hard, very
fine-grained Sandstone, 30% yellow & green
minerals, 70% quartz, finely cross bedded
weathered little - non-weathered flaggy (specimen)

Unit 6 - Covered 37 - 41

Unit 7 - Sandstone 41 - 44 bottom are all
similar to unit 5 except wavy bedded
specimen

8/29/71 MSB No dip - poorly done.

Frenchman cont.

Below pebble cgl - about 4 feet
pale green-gray, ss then green
micaceous shale to top of
brown sandstone.

Brown sandstone begins to interbed
into green shale lower down
hill - (beds measured equivalent)

8/28/71 JSD

Mormon Mtn - 4/23/70
Clear, cool calm

Spot check on previous section measurement

On ridge below unconformity -

A 6 to 8-inch thick sandstone
breccia (conglomerate) observed in the
green clay shale below unconformity.

49' x sin 60°
= 45'

Measured depth - 49' - measured slope 16°
attitude of bed - 30° E. Bed is crumpled
yellow-brown flaggy sandstone very fine-grained.
Angular pieces to about 4 inches in length
are oriented at every conceivable attitude.
Fragments are sharp-edged i.e. not rounded.
Shale above and below contains few worm
burrows - no sign of trilobites observed.

On ridge not on line with section
measurement beginning at unconformity
Check on Unit 21 - slope measurement
27 feet - slope angle 13° - bed attitude
52° SE. Fossils previously collected
from about 15 slope-feet below unconformity.
down slope all covered but opposite hillside
indicates Unit 21 underlain by green
clay shale.

27' x sin 67°
= 24'

15' x sin 63°
= 13'

4/23/70 continued

Overall slope measurement to check
detailed section measurement
start at Bottom of Lyndon Limestone.

① 0-83' slope measurement - slope 24° - Dip 50°

② 0-31' - lithology change from shaly sandstone
to smooth shale - trilobate trail in
smooth shale.

31-100' covered but appears to be
mostly green clay shale
slope 16°

③ 0-10' top of Unit 25, grey and brown
mottled sandstone - underlain by green
sandy shale w/ worm tracks - NOTE - NO SIGN OF
UNIT 24.

@ 50' - dark brown limestone float in
green shale slope walk.

@ 60' - float of harder, micaceous (older)
green and yellow rocks appears.

@ 83' - hard ss rocks crop out

0-88' - break in slope - 15° Dip of beds 45°

④ Next page

4/23/70 cont.

④ 0-97' - mostly slope walk of yellow-
green shale. Color change at this
point and slope reversal. Slope to
back point is 6° . Assume dip 45°

⑤ 0-100' mostly slope walk of yellow,
brown - meta-morphosed-like green ss, shale
etc. mixed with Prospect Mtn debris.
Slope upwards to west, 10° - assume dip 30°

⑥ 0-26' - approximate contact - large
yellow brown ss float ends - very dark brown-
nearly black stained ss crops out nearby.
SS has ^{some} calcareous cement, 5% glauconite -
chocolate brown interstitial fillings or cement.
Attitude not readily apparent but 30°
would be a good estimate. This is the
bottom of Unit 29 or previous measurement.
Underlain by white, pebbly quartzite (not ss)
of Prospect Mtn Quartzite.

Sheep Mtn 5/17/70

Begin measurement in Tapeats

line slope 10° - Bed Dip 25°

0-46 - Sandstone - light cream to light brown, medium grained with quartz granules, cross-bedded, and very hard near top. 36'-40' - pale green, micaceous sandstone with coarse gtz grains in fine grain matrix. See specimen #2

46-98' Sandstone - varies in color from red to brown-red, medium grained, partially siliceified. Three pale green sandy shale strata observed each about 1' thick (direct measure bottom at about 47', 51' and 70'. See spec. #3. Silica bands parallel with bedding. Generally bedding about 1'.

100'+18'

78-118' - Sandstone, tan to grey - top bed red, medium grained, but coarse and pebbly in a few localities. Highly siliceous weathers mostly to sharp fragments. One green shaley part at about 79' covered. This is top unit of Tapeats which grades into overlying shale formation. See specimen #4.

bedding about 1'

CJ

Sheep Mountain Near Jean Nevada
9²⁰ AM. 5/17/70

Attitude near Bright Angel - Tapeats contact
N 28 W - Dip 25' NE

Contact - Granite of Tapeats very roughly established. Some Tapeats in place on granite (dark purple red pebble conglomerate) N 55 E Dip 25 W - estimated 6' of purple cgl. then about 10' white coarse grained white pebble cgl - w/ gtzite pebbles to 4". overlain by purple cross-bedded med-grain quartzite - maybe 5'. Overlain by misc. granule conglomerate purple matrix and grey matrix w yellow pebbles. See specimen #1.
This area generally faulted.

From granite contact to beginning of measured section - paced 118' along creek bottom - all Tapeats ss extensively faulted - direction of fault throws of fault north westerly - basement rocks apparently up.

Page 3

recheck on bedding attitudes in
Tapeats, on poor outcrop indicates
attitude is about N 30 W, 25° NE.
Appears to be slight, changing
in dip attitude ~~between~~
throughout area. No indications
of unconformity at Tapeats - Bright
Angel interface.

5/23/70 Sheep Mtn.
Beginning measured sect in from top
of Tapeats up ward - 7^{am} clear.

Need
line
slope
20^{am}

Bright Angel Unit 1 - 0-56'
N 42° W Dip 26° NE

mottled with red near bottom, sandy,
interbedded with violet sandstone beds
to from 1/2" to 3" thick. ^{most by less than} Sandstone content is
about 35%. Shale & SS are micaceous.
One 3" Sandstone bed near bottom appears to
be over turned - upside down ripples,
about 13" & abundant worm trails.

no
decim^W
6/8/71

Specimen #5. 18' to 39' gypsiferous
green shale - shows as white efflorescence
- one gyp crystal noted. Flat pellets
appear at about 30' - organic origin?
Worm trails throughout unit. Near top of
unit some sandstones are poorly sorted
and have some well rounded, coarse
grains & quartzite grains. Trilobite
fragments taken from gyp beds
near 22 feet.

One brown carbonate - red-brown - bed
2" thick near 40' - contains spicules, curved,
round spines & pellets.

Unit 2 - 55' - 57' - (~~there~~ about 1 foot
direct measure) - Carbonate rock, brown-red

Unit 2 - cont - contains about 20%
very fine grained, quartz sand, possibly
10% organic material (curved spines,
flat spines similar to *hyolithes*, or to a trilobite
leg, and flat pellets). Matrix is red-brown
argillitic - apparent mud + carbonate.
Fraggy bedded. Specimen 6

Unit 3 - 57' - 95' Shale, yellow-green with
30% purple fine-grained sandstone
stringers about 1" thick. Very gypsiferous
near 70'. Trilobite fragments taken from
near 83'. near top sandstone
stringers are chocolate brown and
show trilobite fragments. Specimen 7
(2 bags - one lithology, - one fossils).
Impression that this unit is
upside down - no good criteria.
Unit also appears to be somewhat sheared

Unit 4 - 95' - 99' - ^{Brown} Carbonate rock - green
sandy shale in middle - ^{maroon} red carbonate rock
on top. Carbonates include spicule +
pellet material. Carbonates are about
15% of unit - being 2" to 3" in thickness.
Specimen 8. N 32° W - 21° NE
One trilobite globe or near top in red cont.

5/23/70

Unit 5 - ^{line level - N 40° W, 26 NE} 0' - 43' - Shale, pale green
clay shale, ^{worthy} non-micaceous, non-sandy.
Contains about 20% purple fine-grained ss
in strata less than 1". Shale is sheared
and gypsiferous near 18' + 26'. Some
micaceous shale near 31. Trilobite fragments
(cephalon frag + thorax fragment) near 30 -
too friable to collect. Specimen 9 for
lithology. This unit appears to be
right side up.

Unit 6 - 44' - 48' - (level line)
Carbonate rock, chocolate brown,
sandy to muddy, ^{fraggy} bedded about 2". This
unit contains about 60% fine-grained
purple sandstone. Carbonates extremely ^{high}
in organic fragments, spicules - coral -
flat-pellets. Specimen 10. Some
sandstone stringers in shale way
contains spines, cones etc.

Unit 7 - 48' - 92' ^{line slope 3° up}
Shale, yellow-green to pale green, clay
shale almost no sand, very little
fine mica. Contains about 20%
fine-grained purple sandstone about 1/2"

check
at 100 ft
N 35° W
32

Unit 7 (cont)

in thick mass. A few impression-
red ~~carbonaceous~~ ^{calcareous} ss beds contain
spines & cones & pellets. Olenellid
fragments found at 90'. Specimen
11 - 2 bags one fossil; one litho.

Fault & bed repeat in next unit
up. Change in attitude.

End of field day.

5/24/70

Sheep Mts. Clear
Cool Slope of line 2° down hill →

Unit 8 - 0' to 15' N 15° W 32° NE

0'-3' carbonate rock, brownish red, sandy,
abundant pellets, cones, & spines, flaggy;
3-13 clay shale, yellow green, little mica,
contains a few shrapnel of purple fine-grained
ss, olenellid trilobite cephalon fragments,
13-15 carbonate rock similar to 0-3.

This appears to be the upper limit of
the carbonate-abundant organic zones.
See specimen 12 - fossils & litho in one
bag.

check
thick bed
N 30° W
30°

Unit 9 - 15' to 101' Shale, yellow-green,
sandy, micaceous, with about 40% very
thin fine-grained sandstone strata mostly 1" or less
in thick mass colors are mostly brown
mingle purples, reds. Large Fremontia sp. type
trilobite pleura near 38', brown calcareous ss
at 46' contains trilobite fragments, part of
large Fremontia sp cephalon at 44', some brown
non-micaceous clay shale near 72. Specimen
13.

End of day

2 ← 1 →

5/30/70 Frenchman Mtn. Clear, calm
 Measurement at South end of
 Piche outcrop near Bonanza Street
 extension.

Attitude in Lyndon - $N21^{\circ}E$ $42^{\circ}NW$
 Piche extensively covered
 From top contact - as estimated -
 line slope down hill 23° . Distance to
 unconformity (red ss - brown ss contact) is
 111 feet. Attitude on brown ss which
 contains some green sandy shale is
 $N29^{\circ}E$ $32^{\circ}NE$.

Attitude on red ss $N29^{\circ}E$ $45^{\circ}NE$

From contact measured over cover $100'$ @ 12°
 to rock. Measured another $100'$ across
 alluvial fan @ 3° down hill. Measured
 another $100'$ across fan @ 2° . Measured $80'$
 level to rough projection of Tapent's
 contact.

Moved to central area of Piche.
 Photographed unconformity in black & white
 Plus X 125 ASA

7/11/70
 Recheck - verify
 proper point used
 for unconformity

5/29/70 Frenchman Mtn. Clear, calm
 9am

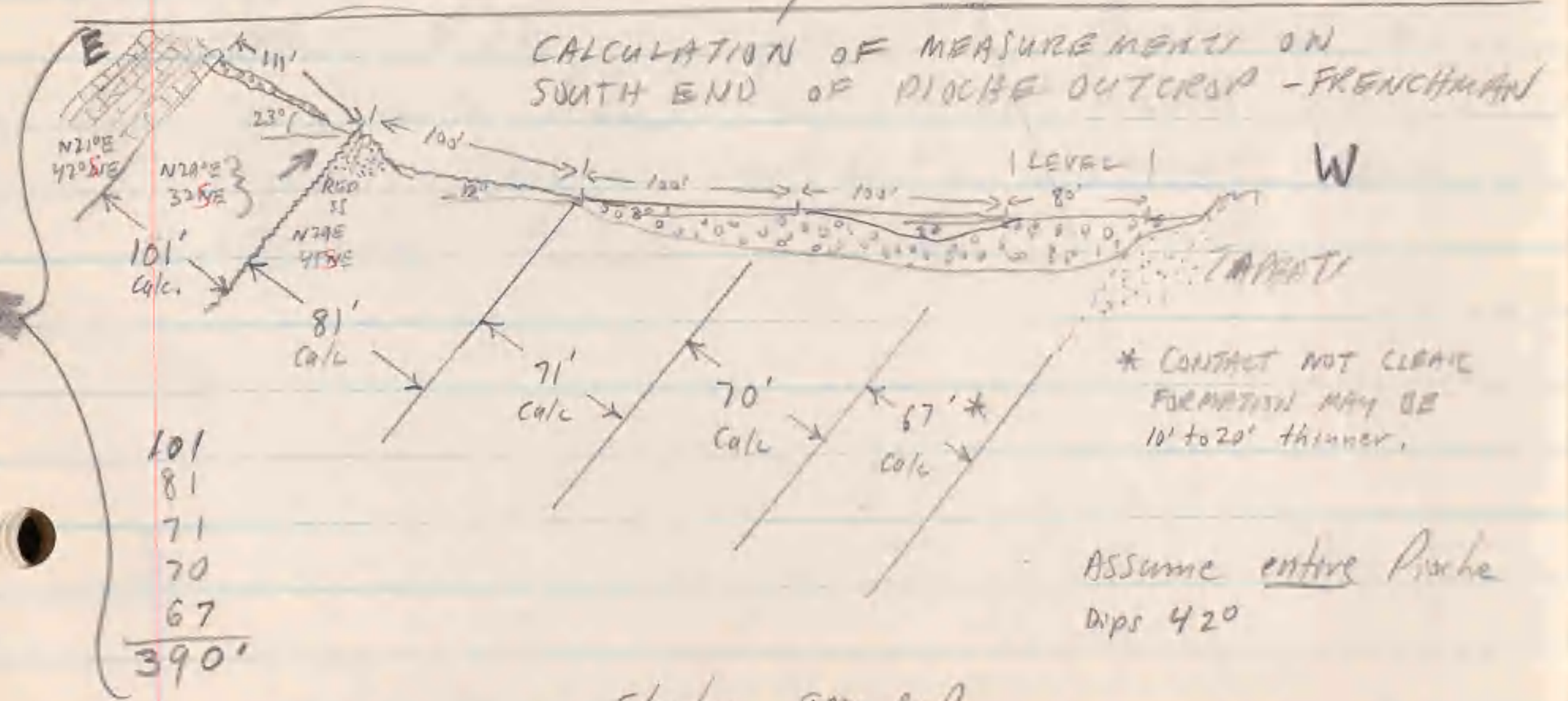
Recheck of thickness of Middle Cambrian
 segment at Piche. Measured overall along
 line previously measured. Overall distance
 $108'$. Formation Dip 45° . Line slope

7/11/70
 incorrect
 point used
 for unconformity

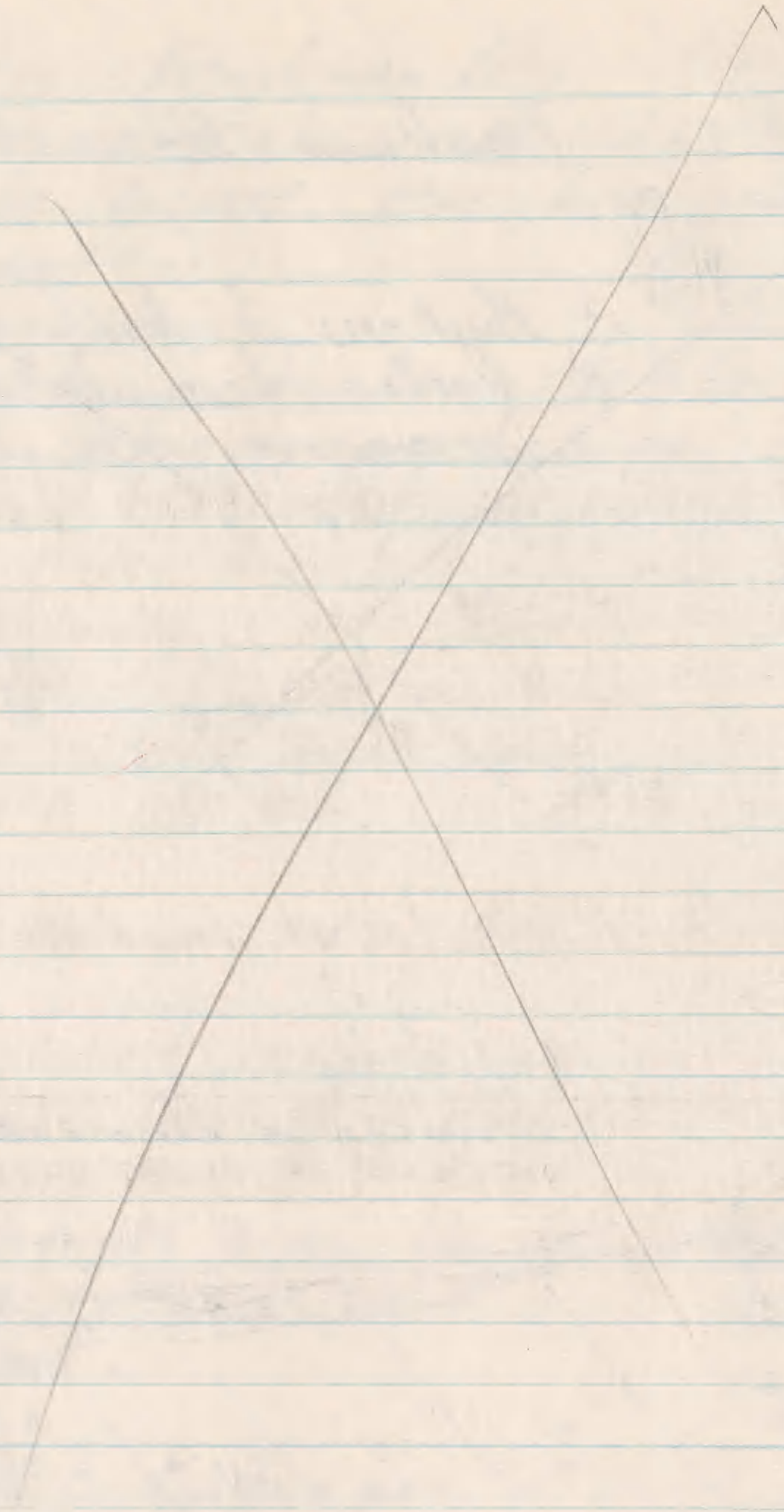


★ Collected fossils at lower zone
P. novata zone

End of day



5/30/70 9pm P.P.S.



5/30/70 Frenchman Mtn Clear, calm.

Measuring - checking original measurements continuation of work started 5/29/70.

Measurement of red ss under unconformity
 Thick bed (slope measurement 22.5') - 43
 line slope 25° down. Attitude N8°E ~~34°SE~~
 5/31/70

Measurement on old line bottom of red ss
 to ~~top~~ bottom of med-grained glauconitic
 ss. Line measurement 80' - slope 10°.
 Attitude N8°E ~~43°SE~~
 46 5/31/70

Moved to old line (lower segment) unmeasured
 down from bottom of med-grained glauconitic
 ss. Line distance 72' to ~~red~~ chocolate
 brown shale - slope 13°. Measured an
 additional 123 feet @ 10° slope to
 Tuffati - Roche contact. General Roche
 attitude N8°E 49°SE.

5/31/70 Calculations for
Change in measured section.

* Middle E to Red ss

$$5/29/70 \quad 108 \times \sin(23+50) = \underline{103}$$

$$46+25+27+12 = \underline{100}$$

* Red ss

$$5/30/70 \quad 22.5 \times \sin(25+46) = \underline{22}$$

$$\text{unit 20} = 22' \text{ w}$$

* Bottom Redss to Bottom Glac. ss

$$5/30/70 \quad 80 \times \sin(10+46) = \underline{66}$$

$$14+4+44+4 = \underline{66}$$

* Bottom Glac. ss to Bottom Brown Shale

$$5/30/70 \quad 72 \times \sin(13+49) = \underline{63}$$

$$11+11+8+23+5 = \underline{58}$$

* Bottom Brown Shale to Bottom Fin

$$5/30/70 \quad 123 \times \sin(10+50) = \underline{106} \text{ Error in calc}$$

$$22+10+17+7+18+26+6+9+5+6 = \underline{126}$$

5/31/70 FRENCHMAN MTN

① Need to recheck dip on Redss
under unconformity. $43^\circ \text{SE } N8^\circ \text{E}$

② Need to check thickness ^{add dip} of units
#16 - Glauconitic ss (5') \leftarrow underlying ss dips 46°
 $80-75$

#17 - dark green shale (56') $75-22 = 53 \text{ w}$

#18 - green gray ss (7) $22-17 = 5 \text{ w}$ ^{partly covered}

#19 - green shale (15) $17-0 = 17 \text{ w}$

overlying ss dips about 35° - slumped? slope of line 10°

③ Need to check units below Choc-maroon shale

#10 - Sandstone (23.9 calc) 0-25' \leftarrow Dip 50°

#9 - green, sandy mica shale (15.6 calc) 25-37 \leftarrow Dip 56°

#8 - Sandstone ^{shale} (15.2 calc) 37-57 \leftarrow Dip 10°

#7 - Sandstone varicolored (8.7 calc) 57-65 \leftarrow Dip 45°

#6 - Sandstone ^{shale} w/ mica + chlorite (5.1 calc) 57-78 \leftarrow Dip 45°

#5 - Shale, mica-green (36.8 calc) 0-30 \leftarrow Dip 8°

#4 - Sandstone 20 coarse gr (7.4 calc) 30-37 \leftarrow Dip 8°

#3 - Sandstone hard buff (6.5 calc) $N10^\circ \text{E } 55^\circ \text{SE}$ 37-42 \leftarrow Dip 8°

#2 - Sandstone, micaceous (3.5 calc) 47-51 \leftarrow Dip 8°

#1 - Shale, sandy w/ ss (5.1 calc) covered at top

127.8 calc.

Re item ① 6' below redss - 2' shale mic $N5^\circ \text{E } 46^\circ \text{SE}$
12' to 15' above ① $N8^\circ \text{E } 58^\circ \text{SE}$

near top ss - green shale contact $N15^\circ \text{E } 58^\circ \text{SE}$
(above unconformity)

Sheep Mountain 6/6/70
Cool - overcast

Checked end of Unit 9 - rechecked
attitudes of base slopes - walked over
upper half of section. (Specimen ^{begin} 14)

Unit 10 - line slope $10^\circ \nearrow$, N28°W 30NE
0 - 27' - Shale, chocolate
brown clay shale with olenellid
trilobite fragments, includes about
20% brown shaley to flaggy fine grained
sandstone with small amounts of mica.
Trilobite fragments & hyolithids collected
and included in Specimen 14.

Unit 11 - 27' - 72'
Shale, dark gray, clay shale with about
20% brown shaley fine grained sandstone
Sandstone includes some ^(5%) very hard
silica cemented shata. Very few worm trails,
and no other signs of life observed.
At 52' is a purple, hard sandstone
bed - estimated 1" thick - ~~fairly well~~
somewhat broken up. See Specimen 15

Unit 12 - 72 - 85 Approximate
attitude (on nose of syncline) N25W 30NE
Sandstone, brown fine-grained, 95%
clear quartz sub angular grains, 5%
glauconite. Fossil to massive - top
bed is about 1 1/2' thick (direct measure).
Specimen 16. This unit includes some green
sandy shale - none included in specimen.

Moved on strike ~~to~~ southeastward
across stream about 400'.

Unit 13 - 0-100' line slope 2° up \swarrow N50W 38°NE
Shale, green clay shale with small
amounts of sand and mica. Includes
about 10% glauconitic quartz sandstone
fine-grained, fossil to flaggy. Glauconite
content about 10% but one 3" unit
had contains about 35%. Near 38'
Trilobite fragments near 1' and tail
near 99' - worm tracks rare. Zone
appears to have little life. Specimen 17.

Unit 14 - 0-77' line slope 3° \swarrow N50W 32°NE
Sandstone, a series of various colored
SS beds with some shale.

from

Unit 14 - cont.

0-4 - about 1' thick bed of tan ss
very fine grained with "needle" holes to 1"
vertical to bedding plane.

4-22 - covered contains some sandstone
& some brown-red shale

22-24 - purple, fossil, sandstone very fine grain

24-28 - red, fossil, poorly cemented sandstone
very fine grained - trace, micaceous.

28-31 - yellow, carbonate-cemented,
ferruginous, very fine grained cross-bedded
sandstone

31-49 - tan - fossil to shaly (platy)
quartz sandstone with minor glauconite.

49-58 - green sandy shale

58-69 - purple sandstone fossil platy
very fine grained

69-77 - Brick-red, micaceous, very fine grained
sandstone - roughly one bed of 4" strata
more or less solid. Poorly ^{little cemented} cemented,
weathers round.

Specimen 18.

Unit 15 0-44' line slope 16° up \swarrow N50W 40NE

Shale, chocolate clay shale, with ripple
marks & worm trails. Contains 15% very fine
grained sandstone and 2% green shale.

Unit 15, continued.

Sandstone contains dices of shale which weather out leaving an organic-appearing impression. Specimen 19.

Shale sandy & micaceous, with clay. Outcrop resembles clay shale but rock is harder, splits poorly & is sandy. No trilobite indicators (tracks or fragments)

End of Day

Sheep Mtn 6/7/70 7am
Cloudy - Breezy

Unit 16 - 0 - 58' N48W ³⁸ ~~21~~ NE line slope 4° down
0-17' Sandstone, dark red, shaly very fine grained, chocolate brown shaly partings. SS is micaceous. ~~Top of~~ At 17' very pale green sandstone with shale dice in clus. All show ripple marks. Specimen 20
17-58 Shale, chocolate brown with a few green streaks. Specimen 21. Some fissile, brown shaly sandstone in upper part. Worm trails casts near top otherwise ~~the~~ no indications of life in shale

Offset about 100' SE to avoid contact faulted beds

Unit 17 - 0' - 48' line slope 11° down
N30W 45° NE.

0-22 - Sandstone, brown, very fine grained ripple-bedded, shaly

22-34 - Shale, pale-green sandy mostly sand near bottom - more clayey at top, micaceous. Trilobite ~~by~~ *Plenus* impression collected.

34-48 Sandstone, tan and pale green alternating. continued over

Unit 17 - continued
tan sandstone, is weather resistant,
fleshy, very fine grained. Green sandstone
covered - produces fine ~~sandy~~ powder,
friable lumps from dug hole. Specimen
22.

Off set to cross fault about 20' SE.

Unit 18 - Shale - 15' ~~thick~~
Shale, sandy green, sheared &
crumpled approximately 15' estimated
(direct measure) bottom covered under
catcher cemented alluvium.
Specimen 23.

Unit 19 - 0-53' N35W 35NE ^{incl. slope 30° down}
Shale -
0-13' ^{Sandstone} ~~Shale~~, crossbedded fine grained tan
sandstone

13-53' Shale, pale green, sandy with
few lenses of sandstone to 10mm, no
life indicators noted. 4" yellow carbonate
bed in shale at about 17'. Specimen 24

Unit 20 53'-94' same line same attitude
Sandstone, red-brown, fine grained.
hard, spheroidal weathering bed at top - unique to
the area. see next page

Unit 20 - Cont.

Sandstone, fine grained, weathers
to small shaly fragments, beds to about
6". Micaceous. Some shaly parting.
Specimen 25

Unit 21 - 0-59' slope 14° up - ^{attitude changing} _{assume 28° D.P.}

Covered mostly by red shale - can
be seen nearby. Specimen 27 taken off line
200' NW. Top 6' green sandy shale. Lower remainder
is maroon red shale - all with ripple marks,
micro ripper, some ss w/ shale discs, few worm
casts. No trilobite tracks etc.

Unit 22 - 59'-81' N35W 20'NE line 14° up

Sandstone, yellow, beds vary from
2" to about 3'. Cross bedded. Carbonate
cement. med. grained. Top of this
unit is in contact with dark grey
limestone unit "Lyndon" limestone.

Specimen 26. First few inches is sandstone
with some glauconite & few vertical worm
borings (needle-like). Remainder is cross-bedded
grains are glauconite altered to yellow
material medium grained, spherical. 40%. Carbonate
surrounds each grain.

End of day

6/14/70 Mormon Mtn
Clear - cool

Began at unconformity - sampled
rocks at unconformity. Immediately
below unconformity - yellow-green micaceous
sandy shale. On top of unconformity are
broken up, partly rounded slabs of
glauconitic limestone - about 4 inches
thick. On top of the limestone slabs is
a 2-foot-thick sandstone bed - mostly fine-
grained quartz with lime cement.

In the area where the previous section was
previously measured, the formation contains
several beds of limestone and sandstone
varying from a few inches to as much
as 4 feet in thickness. In tracing the
formation southward, most of these beds
disappear in gliding the beds marking
the unconformity. About 1 mile south
of the measured section the formation
appears to consist almost entirely of
shale, the upper half being green clay shale
with little sand and mica and the
lower half being yellow-green to yellow-brown
with significant amounts of sand and
mica. In this area the formation

appears to be significantly thicker -
500' here - ^{assumed 520' (some showed 470')} 370' at measured section.
The extra thickness would be in the
lower half of the formation. The
possibility exists that an undetected
strike fault has cut out part of
the lower part of the formation in
the measured area.

In returning to the measured
section area, one sample of limestone
was collected for acid dissolving. It
contains fragments of (1) hydroids,
(2) some minute cylindrical spine-like
segments and (3) some fragments of
trilobite-like invertebrates. The "thick
dolomite" mentioned by Wheeler was
examined. Appears to contain no
fossils.

End of day

7/7/70
Frenchman Mtn. 5³⁰ am Hot

At unconformity photographed by Gayle
under Power Line to Beacon

(1) Measured down from base of Lyndon
to unconformity - 122 feet on slope of 22°. Formation dip 52°. Sandstone unit on
top of unconformity is 21 (slope foot) -
tan, fine-grained, few ripple marks.

(2) Measured down from base of Lyndon
to unconformity in creek bottom - 107
feet on slope of 16°. Formation dip
49° - Good dip measurement. On
scoured surface upper unit "fresh" rock
is tan with greenish cast. Unit below
unconformity is orange-red to maroon
red. Upper unit here is 16² feet on
horizontal measure - estimate 8 feet actual

(3) Approximate measure on Lyndon Limestone
Bottom unit 5' yellow stratified limestone
Middle unit 58' massive gray limestone
Upper unit 25' yellow stratified limestone

Total	88'
-------	-----

 (appears to be silty - beds 5' to 2 inches)

END OF DAY

129'
calc.
20'

~~107'~~ 97'
calc.

8'

88'

10/10/70 Frenchman Mts.
Clear - Cool

1. Photographed unconformity
Noticed "Scolithes" burrows in
Middle Cambrian sandstone just above
unconformity in creek bottom.
2. Collected trilobite fragments from
top of Lyndon Limestone. Trilobites
are in the uppermost carbonate bed
overlain by green shale of Chissolm.
3. Examined Chissolm which is almost
entirely covered. Weathers deeply. Found
an Ogygopsis-like pygidium in sandstone
float. Chissolm is green shale at
bottom - some maroon to chocolate
shale about 1/3 up from bottom -
may, yellow to brown sandstone
~~spots~~ fragments show trilobite
fragments - some parts of Chissolm
appear to contain substantial
gypsum, disseminated in sediment -
near top is a green shale
fragment, agglomerate with matrix
of carbonate material.

Frenchman Mtn.
4/3/71 mild light breeze

Took Dr. A. R. Palmer, grad student Bob Halley, and field assistant Barbara Halley, on orientation tour of Pioche Shale, fossil zones and unconformity. Stopped briefly at Hank Gayler's excavations in Chisolm where Dr. Palmer identified *Glossopleura* fragments.

1. Re-name Pioche Shale - Palmer says the name should be discontinued in favor of Bright Angel Shale (formation?)

2. Re-unconformity, Palmer recommends more local measured sections to prove beyond doubt - he did not commit for or against although the evidence at this time is inadequate.

3. Re-trilobites in top of Lyndon, Palmer says he has seen them at the other end of the fm. - recommends heating and chilling to break fossil out.

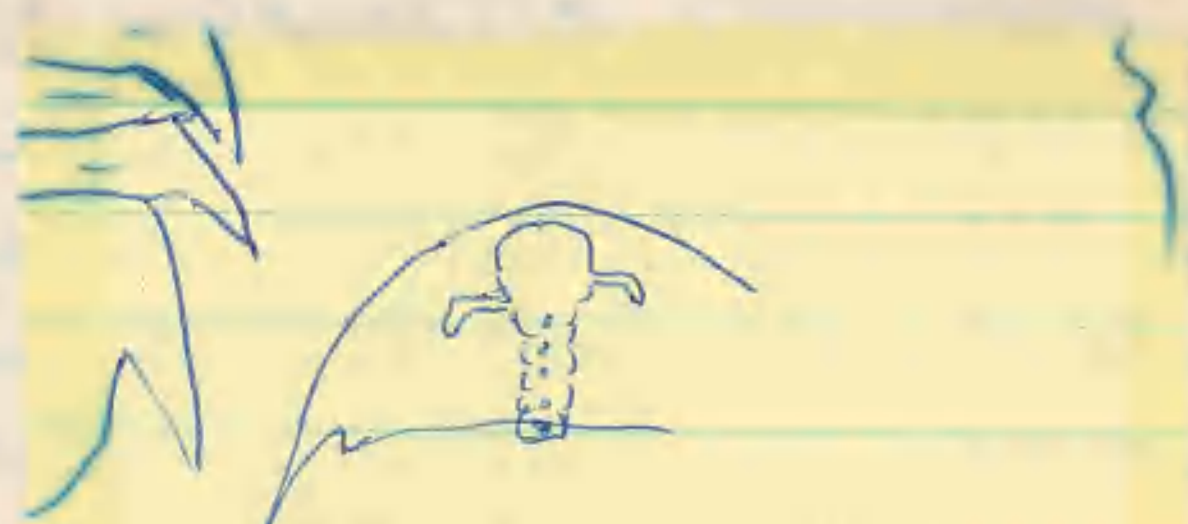
4. Furnished Palmer a photograph of Hank Gayler's *Glossopleura* which Palmer confirmed as such. Palmer found *Glossopleura* fragments in current digging and near bulldozer cut

Frenchman Field Trip 4/2/71

in Chisolm

5. Palmer looked through our Albertella collection and identified two types (long eyed and short eyed) noting that the short eyed A. has third macropleura while long eyed A. has 4th macropleura.

6. Palmer checked our collection of F. multinodus and said only one was his F. multinodus; the others are only close relatives. The latter specimen similar to multinodus is an openellid - undescribed, that far. Palmer sketched multinodus - see attached.



→ Palmer's sketch of multinodus

7. Palmer looked briefly at the large Freemontia collection with interest but no particular observation except good specimens.

Frenchman Field Trip 4/3/71

8. Palmer looked at Albertella-associated trilobites and identified them as small Mexicella - said they ^{grow to be} get about three times the size of ours. (He noted that on one Albertella specimen there was another, partial head of a ptychopariid trilobite (which he "hates", so don't try to identify further!).)

9. Palmer mentioned that Zaccanthodes may be found here as it is frequently found with Albertella. He noted that the Albertella have a pebbly textured surface.

10. In response to my comment about displaying the Lyuda and having nothing left but small, green two pronged spicules and spherical mud-like shells - he said the spicules were "Chancelloria" - same as Dr. Cramer at UCLA.

April 18, 1971

Charlie Shelton - St. George

^{Peter Krewit}
Trip to Mesquite, Nevada and to the new highway cut through the Virgin River Narrows. Road work still far from complete but most of rock excavations seemed nearly complete. Then closed but watchman permitted me to drive through the narrows to the Mesozoic rocks to see if there was any green shale exposure. If so, I could get an OK to enter on Saturday or Sunday from Charlie Shelton, Superintendent, for Peter Krewit at St. George, Utah.

The green shale outcrops were small, badly disturbed, sheared and faulted. No Tapeats underlying unit in sight and rock generally more sandy and less shaly. Maybe 50 feet of material exposed - no fossiliferous seen. No apparent value in trying to measure.

Picked up 3 rocks - one a blue limestone with glauconite - two glauconitic sandstones w/ mica.

7/19/70

Frenchman Mountain

Dug two, 4 foot holes in Alberella zone overburden without success. ~~fully~~ Failed to reach rock in place. Dug several small holes beneath red-weathering sand stone (lower Cambrian side? of unconformity) without success.

Walked up to Lyndon and collected some limestone rocks for heat treatment.

4/20/71

4/20/71

Diamond Bar Ranch

Left for Bright Angel section about 7 am. Arrived, after breakfast in Henderson, about 10 am. Examined section just east of Diamond Bar Ranch (through two closed gates).

Collected one coarse-grained glauconitic sandstone from ~~top~~ within about 15' of top of Bright Angel for heat treatment - contains for/bite.

Collected several *Glossopleura pygidia* from chocolate shale about 10' or 15' above Orange dolomite.

Noted erosional surface where several small ~~beds~~ sandstone beds were eroded away and dolomite deposited on that surface.

Collected one short-eyed *Alpertella* from pale green shale. Stratigraphic position not readily apparent - due to suspected faulting in the vicinity.

5/9/71

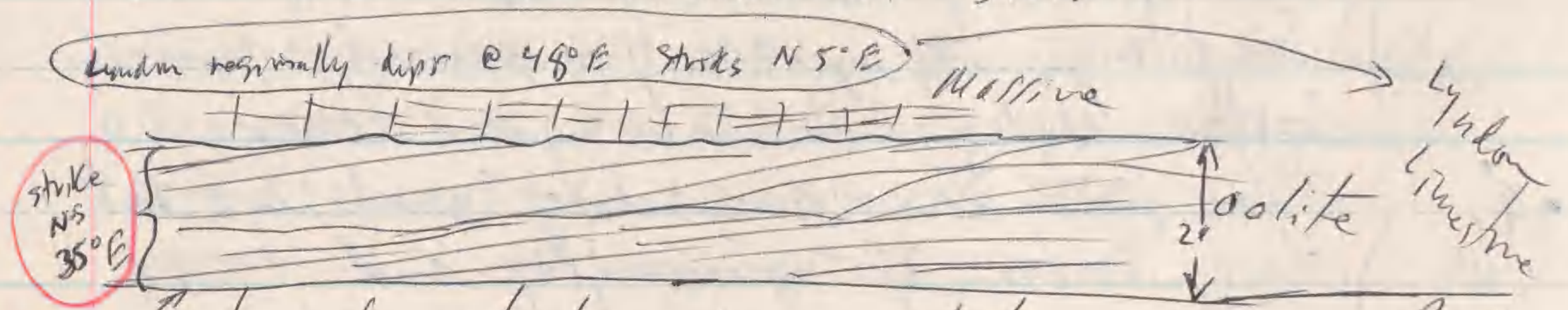
Freuchusa Mtn

W/ Kelly Barton Dug in lower zone just across Fresh creek. Found few trilobites - mainly resembling an Olenellus rather than Freuchusia. About 6 specimens found. Possible indication of an Olenellus zone between the lower zone containing Paedemian readevici and the Diceratops zone.

Frenchman Mtn. 5/16/71

Beginning new section measurement south of Power Line hill.

Bottom of Lydon shows massive limestone with lowermost two feet bedded oolite. Beds to 4". Massive ls on an erosional surface -



Nature of contact unknown but appears to be gradational. Specimens dug out with pick are poorly cemented, fine-grained glauconitic sandstone, mostly green in color. Probe shale

- slope of ground type 29°
- 0' - 9' dint 1 Covered w/ limestone talus
 - 9' - 11' dint 2 Sandstone outcrop - fine-grained 10% glauconite, remainder quartz, tan in color - bedding 0.5" to 2".
 - 11' - 95' dint 3 Covered w/ limestone talus. Green weathered shale cropping out in ter inefficiently from 72' to 95' where lithology changes to sandstone.

N 4° E
54° E

5/16/71

Unit 4 - 0' - 6' slope of ground & top 29°
Sandstone, tan, very-fine grained, nearly
all ^{clear} quartz, uniform gradation, bedding cross
bedded, stata to 2", interbedded with
green sandy shale stringers (laminae) to 1"

Attitude same as above. Weathers to sandy flake
and slabs - cementation weak. weak ^{reacting to} acid.

Unit 5 - 6' to 24' ~~partly covered.~~

Sandstone, tan, very fine-grained, generally
~~harder~~ harder than above and denser. No
shaley partings. grains white (quartz) but not
clear, contains 2%± glauconite, and traces
of mica. Lower contact covered.

Unit 6 - 24' to 28' ~~sandstone~~ ^{check part 7' of shale 14'} partly
covered. Shaley sandstone, very fine grained
vari-colored gray, greenish, reddish, shaley
partings, papery. Micaceous - readability apparent.

Unit 7 - 28' to 67' Sandstone,
red-weathering, very-fine grained, glauconitic,
micaceous, some carbonate cement, ripple-bedded.
Contains some gray to brown sandy shale partings
- say 5% of unit. ~~Grain~~ Grain size and bed
thickness increase in bottom 5'. Fresh surface
of rock appears dark red-purple to brown.
Glauconite & weather glauconite account for color.
Much clear quartz apparent

29°
slope

Assume
dip
52°

5/16/71

Unit 8 0' to 40' - Slope 16° - Shale,
green, clay shale with very-fine grained
green sandstone stringers to 2". This section
partially covered but in vicinity of line green
shale outcrops well enough to project entire
unit. N8°E 50°E upper part of unit is
micaceous.

Unit 9 - Direct measurement - 2 feet thick -
Sandstone, brown, medium grained, cross bedded,
beds to 1' thick, mostly well rounded, poorly
sorted quartz grains with about 10%
glauconite - ~~at~~ removed by weathering from
surface, but inferior contains rusty remnant.
Strong ^{reaction} calcareous cement.

Unit 10 - Direct measurement = 3 feet thick.
Sandstone, pale green, beds from 1' to 3"
parallel-bedded - i.e. not crossed, very fine-grained,
mostly well graded quartz, 1% glauconite
generally fresh, calcareous cement. The
bottom layer of this unit is cross bedded
~~course~~ medium grained sandstone apparently
on an eroded surface on the green
clay shale underlying.

5/16/71

Unit 11, 0' to 32' Slope 15° Shale, green clay shale with hard sandstone stringers. Stringers (2" ~~beds~~ to 0.5" beds), show (very scarce) trilobite walking trails, well developed ripple marks. SS stringers gray-green w/ mica on bedding planes. Shale is sandy and highly micaceous. SS cement non-calcareous. Bottom 2' of shale is yellow green in contrast to dark green of upper 30'.

Unit 12, 0' to 12' slope 25° Sandstone unit with sandy shale. Top bed - dark brown, medium grained poorly sorted, well rounded w/ 10% weathered glauconite, ^{carbonate cement} ~~remains~~ 0.5' thick. Next bed medium grained, clear quartz w/ some glauconite, 0.5' thick, non-calc. cement. Remaining beds 4" to 1" with green shale separations - very fine-grained, 5% glauconite remainder quartz, fresh, hard unweathered.

Unit 13 - 0' to 44' - Slope 19° - Green shale w/ sandstone stringers. Upper 26' yellow green, lower 18' pale green. Unit contains about 30% sand stringers mostly thinner

N30W
55° NE

5/16/71

Then 1" - two or three are 2". Unit is micaceous. Part of an openellid trilobite at 34' (slope). Lower 6' (slope) begins transition to ~~brown~~ the red-brown shale. In this unit 13 sandstones are green with green shale gradually (in lower 6') giving way to brown shales. In red-brown unit underlying both ss + sh are red-brown. — End of day — 1:00 pm. Wind and sand plumes rising from valley floor.

5/19/71
Frenchman Mtn - Bright Swamy Canon

Continuing section measurement begun on 5/16/71.

Review of measured units, thus far to put on color chart color.

Units 4+5 - sandstone pinkish gray (5YR 8/1) color. Bottom two feet includes some (2'±) strata which may be reworked from the "red-weathering" unit below. These strata are crumbly, dark brown, weathered glauconitic.

Unit 6 - Shale, sandy - remeasured direct measurement 5' - the extra foot should deduct from Unit 5 in which it was included. Color - brownish gray - mainly some mottling of other colors (5YR 4/1)

Unit 7 - Sandstone - "red-weathering" grayish red (5R 4/2)

Unit 8 - Shale, greenish gray (5GY 6/1)

5/19/71

Unit 9 - Sandstone - 2' thick pale yellowish brown (10YR 6/2) weathered surface

Unit 10 - Sandstone - 3' - grayish yellow green (5GY 7/2)

Unit 11 - Shale^{with} - (trilobite walking trail and some scratches near 3' from top) Grayish olive (10Y 4/2) near top micro-ripple mark near center of unit, grayish olive near bottom - slight color change apparent but not measurable - bottom slightly more yellow.

Unit 12 - Sandstone - very large ripple marks - say 4" crest to crest - color rather very descript - rock greenish and weathers brown. - no color taken

Unit 13 - Green shale - near top 3' light olive gray (5Y 5/2) - scratches few - clayey + very fine. near bottom (5GY 6/1) greenish gray very micaceous and sandy -

upper 26' (slope) light olive gray remainder to ~~check~~ brown-red shale 1' greenish gray.

5/19/71

~~Unit 14~~

Beginning section measurement from marked bottom of unit 13.

"Red" shale unit 2

Unit 14 - 0' - 13' slope ^{19°} Brownish gray (54R4/1)

Shales with ^{hard} sandstone strata and lenses to 2" thick mostly about 1/2" thick.

Sandstone is micaceous on bedding planes.

Some trilobite scratches and micro ripple marks

N 5° W, 58° NE Direct measurement ≈ 8' on

this unit. Sandstones are hard, very fine grained, non-calcareous reaction.

Unit 15, 13' to 22'

Shale, greenish gray (^{last page}) clayey

some mica, contains numerous ~~to~~ very fine grained sandstone strata mostly 0.25" but

~~30'~~ a few ^{are} thicker ones three or four are up to 2" but thin laterally. Thicker ss strata have

calcareous cement. Abundant scratches and some worm trails. N 5° W 58° NE.

Bryozoa heradensis near 19'

Unit 16 - 22' to 25' (about 1/2' direct

measurement) Sandstone, very fine grained,

somewhat shaly and lumpy in texture

yellowish gray (547/2) non-calcareous,

no glauconite visible, no mica

5/19/71

Unit 17 - 25' to 43' N 2° E 54 NE

Shale generally pale olive (10Y 6/2), sandy and silty with very fine mica contains about 25% sandstone layers 1/4" to 1/2"

but some are up to 2" all hard - ~~hard~~ At top shale includes a few reddish shale streaks

and top is a hard, dark brown, very fine grained calcareous sandstone which may include some

organic materials - there appear on weathered surface - on fresh surface nothing can be seen.

Near 30' shale is more abundant in larger mica, sandier and shaly parting rough and

hackly.

Unit 18 - 0' to 21' - slope 6°

thorly covered. Top bed is medium grained sandstone - all well rounded grains.

Several feet of shaly sandstone erode out weathers, dusky yellow - some "scratching" as

by trilobites.

Unit 19 - 21' to 28'

Hydrothermal Zone

Top 6" = red iron cemented coarse to medium grained sandstone all well rounded g&g grains

very dark red (5R 2/6) - see next page

Unit 19 cont.

Next 6" - similar rock w/o iron stain color olive gray. Next 6" - red cemented coarse grained ss. Next 6" - ~~white~~ pinkish gray sandstone - about 20% well rounded white and pale yellowish coarse grains with matrix very fine white fine grains, appears to be bleached. Next 2' - violet colored, apparently leached sandstone (mostly white as above) with very light gray to pale pink color imposed. Some sericite developed. This may have been a green-yellow rock ~~the~~ silty sandstone altered to ss by destruction of greenish silty particles.

Unit 20 - 28' to 37'

Sandstone, shaley, dusky yellow (54 1/4) to greenish gray (56 1/4) very fine grained, rough, blocky shaley parting, very fine mica, bedding about 1' thick, non-calcareous

Unit 21 - 37' to 52'

Shale, sandy with 1/4" to 1/2" sandstone strata, greenish gray (56 1/4) micaceous, partings somewhat blocky, some clay shale included. Trilobite at 49' *P. fremontia*?

5/19/71

Unit 22 - ~~50'~~ 52' to 95'

Covered - contact is within 2 or 3 feet - based on project up from nearby outcrop. A couple of 2' hard sandstone beds project to line at about 84' (to 88') and 89' (to 91'). Between ss beds is shale. Beneath ss bed is shale. Top of Tapeats is coarse-grained typical sandstone of Tapeats. Dip Tapeats ~~60°~~ 59°

3' above the hard cross-bedded ss that projects to 84' is a 4" dark red iron-cemented coarse grained sandstone - which seems to be fairly continuous locally. Immediately above the red-ss is shale (dark gray) which may produce trilobites.

- 5/22/71
- Frenchman Mtn - Popeline South
- ① To recheck total thick ness
- ① Attitude of Topcats N3°E S9 SE
 - ② Direct measure on red shale above Bizeradoys zone (Unit 14) - 12 feet.
 - ③ Checked direction of section line - essentially east west.

Starting at first shale under Lydon

0-96' ~~top~~ bottom of green shale - top of tan sandstone

0-100 - line slope 28°

- ① Collected trilobite fragments in yellow-green sandy micaceous shale 1 foot above top of tan sandstone - *Albertella et al.*

0-100 - line slope 23°

- ① 16 bottom tan ss ^{unit 5} - top sandy shale
- ② 23 bottom sandy shale ^{unit 6} - top red weathering ss.
- ③ 63 bottom red-weathering ^{unit 7} sandstone

0-100 - line slope 19°

- ① 9'-20' med. gr. glauconitic ss
- ② 48'-53' med. gr. glauconitic ss
- ③ 28' is a 6 inch brown sandy limestone bed appears to include trilobites. ^{same bed}

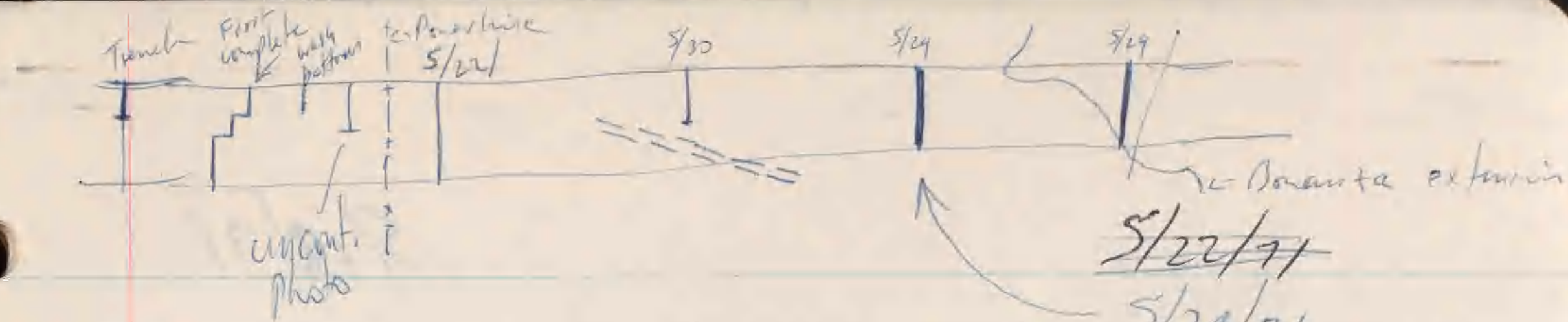
5/22/71
section check continued.

0-100' line slope 6°
@ 2' - top red shale
@ 70' - top "hydrothermal" zone

0-46' line slope 8°
@ 46' bottom of Roche - top of Tapeats
point of contact may be 2' longer
than initial measure.

Searching for fossils in Unit 13
Top half (26' slope) is clay shale with
abundant ~~worm~~ trails in upper half
Lower half (18' slope) is very micaceous
sandy shale - or probably better called
shaley sandstone - shaley parting is
usually very thin bedding laminae.
Unit 13 is clearly two lithologic
units - lower sandy unit seems to be
without life - upper unit seems to
have been abundant in various populations.

Trilobite walking trails between brown
6" sandy limestone and bottom of med gr. glauconitic
sandstone unit (upper unit).



5/29/71
Frenchman Mtn - Cool Cloudy Breezy
Near Center of Outcrop to begin new
Section.

1. Photographed contact of Roche with
Tapeats in prospect hole. Tapeats
at attitude N10°E 62°SE. Roche rocks are
~~sandy~~ micaceous shaley sandstone
green and purple with occasional
coarse well rounded grain. Otherwise very
fine grained. Tapeats is well graded very fine
to very coarse buff to (brown weathered),
almost entirely quartz. Tapeats color -
on ~~weather~~ outcrop Very pale orange 10YR 8/2
to Grayish Orange Pink 5YR 7/2 - brown
varnished on bedding planes. Roche color
(purple) is actually light brownish grey 5YR 6/1
to brownish grey 5YR 4/1. Green is yellowish
gray 5Y 7/2.

2. Photographed prospect pit in "hydro"
zone. Green shale overlying hematite
concreted rocks is strongly sheared. Bedding
N10°E 72°SE on sandstones in "hydro"
zone.

5/29/71

Begin section measurement in same area as covered last year - near south end.

~~Top Lyden~~ N10°E, 45°SE
Contact approximately set ± 1 foot due to cover

Unit 1 - 0-4' - Sandstone, red grained, nearly pure quartz with very fine green accessory mineral. Rusty yellow and pale green mottled

Unit 2 - 4' - 8' Sandstone, greenish tan, very fine grained, minor amount of mica, extensively ripple marked and pitted on bedding planes.

Unit 3 - ~~8' - 18'~~ Covered. This is the region where green shale should exist but examination shows

Unit 3 - 8' - 18' - mostly covered but seems to be underlain mostly by green shale, sandy.

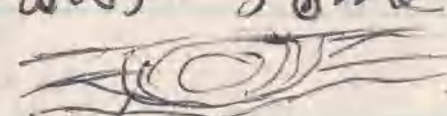
Unit 4 - 18' - 19' - Covered but digging shows red shale with high gyp content

Slope 26° ↑
↓

5/29/71

Unit 6 - 19-21 - Sandstone, thin bedded, light brown, very fine grained, micaceous, beds to 2".

Unit 7 - 19-30 - "Siltstone" - test pits show very powdery, highly gypsiferous green and red micaceous, light-weight, friable, salty shale. Outcrops not apparent. This unit melts down and retains slickensided cover as well as weathered shaly products. Hand size gyp honeycombs dug with shovel

Unit 8 - 30' - 53' Sandstone, tan, weathers to beds of 3 or 4 mm - extensively ripple-bedded, very micaceous, shows some shelly structures near top  spherical weathering type structures. N10°E 46°SE at top. This unit includes a few thin lenses of gypsiferous green shale - gyp causing exfoliation of the rippled bedding photographed.

Slope 26° ↑
=

Unit 9 - 0-20 Sandstone, green and tan alternating, friable, very gypsiferous, melts down quickly, outcrop in wash ^{VEG MICACEOUS} _{only}

5/29/71

↑ slope 19°

Unit 10 - 20' to 89' Covered, alluvial slope wash, large limestone boulders.

Unit 11 - 89 - 100' Sandstone projected to line from 50 feet north - red-weathering unit - top and bottom not apparent approximately 12' direct measure exposed - this line is covered the remainder of the distance to the bottom of the formation.

Unit 12 - 0' - 100' Covered Slope 15°

Unit 13 - 0' - 100' Covered Slope 10°

Unit 14 - 0' - 93' Covered Slope 7° Contact estimate from outcrop, about 100' to north could be off too long by up to 5' feet on chain.

Beginning another partial section at South end of outcrop - about sample place as overall measurement was made.

5/29/71

London N20°E 45°SE - roughly - the formation is disturbed by faulting or movement along joints to 2'.

Unit 1 0' - 58' Covered.

Unit 2 58' - 89' Partly covered but mostly green shale, lower most 3 or 4 feet yellow green.

Unit 3 - 89' - 106' Sandstone with green shale interbedded, tan sandstone N25°E 43°SE, 99' to 106' essentially without green shale parting

Unit 4 - 0' to 45'± Sandstone, red weathering N20°E, 46°SE. Thickness approximate - contact covered but estimated from test pit nearby. May be off 3± feet. Top 3' weathers quickly found only by digging. Remainder Covered.

↑ slope 17°

End of day

5/30/71
Frenchman Mtn - near center of
out crop.

- ① Fault off set of about 4 feet, seen
cutting "hydro" zone and disturbing
rocks up to the red shale zone.
- ② Sand stone about 15 feet above red
shale includes numerous shale flakes
as at Sheep mountain.

Lyndon Limestone N 50° E 47° SE

Unit 1 - 0' to ~~10'~~ 6' Sand stone,
dark green, medium grained, very glauconitic
some mica. beds 2" to 1 foot.

Unit 2 ~~10'~~ 6' to 13' Sandstone,
tan with green shale partings, beds 1/4" to 1"
worm tracks and very small pits on
bedding plane

Unit 3 - 13' to Covered -
appears to be mostly green clay shale.
Small float flake with "tracks"
collected at top of this unit.

Slope 26°

1 slope 26°

Unit 3 - continued 13' to - 92'
31-33' light brown sandstone
40' red shale or siltstone outcrop
59-92' mostly green shale?

Unit 4 - 0' to 8' Sandstone,
tan weathering, very fine grained, N5°E 53°SE

Unit 5 - ~~0' to~~ 8' to 11' - shale,
green ^{and red alterations} micaceous with sandstone laminae

Unit 6 - 11' to 13' - Sandstone, tan

Unit 7 - 13' to 18' Red weathering
Sandstone

2 slope 28°

Unit 8 - 18' to 20' Shale, sandy,
brown & red, very fine mica,

Unit 9 - 20' to 38' ^{N50°E 51°SE} Sandstone, red
weathering - not as strongly red as in
most cases.

Unit 10 - 38' to 67' Sandstone ^{N3°E 43°SE}
red weathering, strongly cross bedded,
beds 1' thick, a few shale flakes in
sandstone, spheroidal weathering near 43.

Note Separation of red weathering
and tan should be at about
36'. NB 5/30/71

5/30/71

Spent one hour digging in 2' shale
Unit 5 - worm burrows only.

Unit 11 - 0' to 39' Sandstone -
green shaly, ss with shaly to 1" of
hard sandstone. Shaly ss is ~~not~~ micaceous
ss is very fine grained, pale green &
closely resembles clay shale but contains
minor amounts of clay.

3 slope 18°

Unit 11a - 39' to ~~67'~~ 70' Covered.
One foot-thick bed of hard, ^{pale} green sandstone
about 49' - very fine grained 95% quartz -
5% glauconite. (67' to 70' green clay shale)

Unit 12 ~~67'~~ 70' to 74' Sandstone,
fine-grained glauconitic, beds 1' thick,
some gross bedding,

Unit 13 - 74' to 79' Sandstone,
shaly, green with some clay shale

Unit 14 - 79' to 82' Sandstone, fine grained
thick bedded (1' to 3'), glauconitic, hard

Unit 15 - 82' to 102' - Covered -
appears to be mostly green shaly
sandstone with sandstone strata of
1" to 2" uniformly distributed. Micaceous.

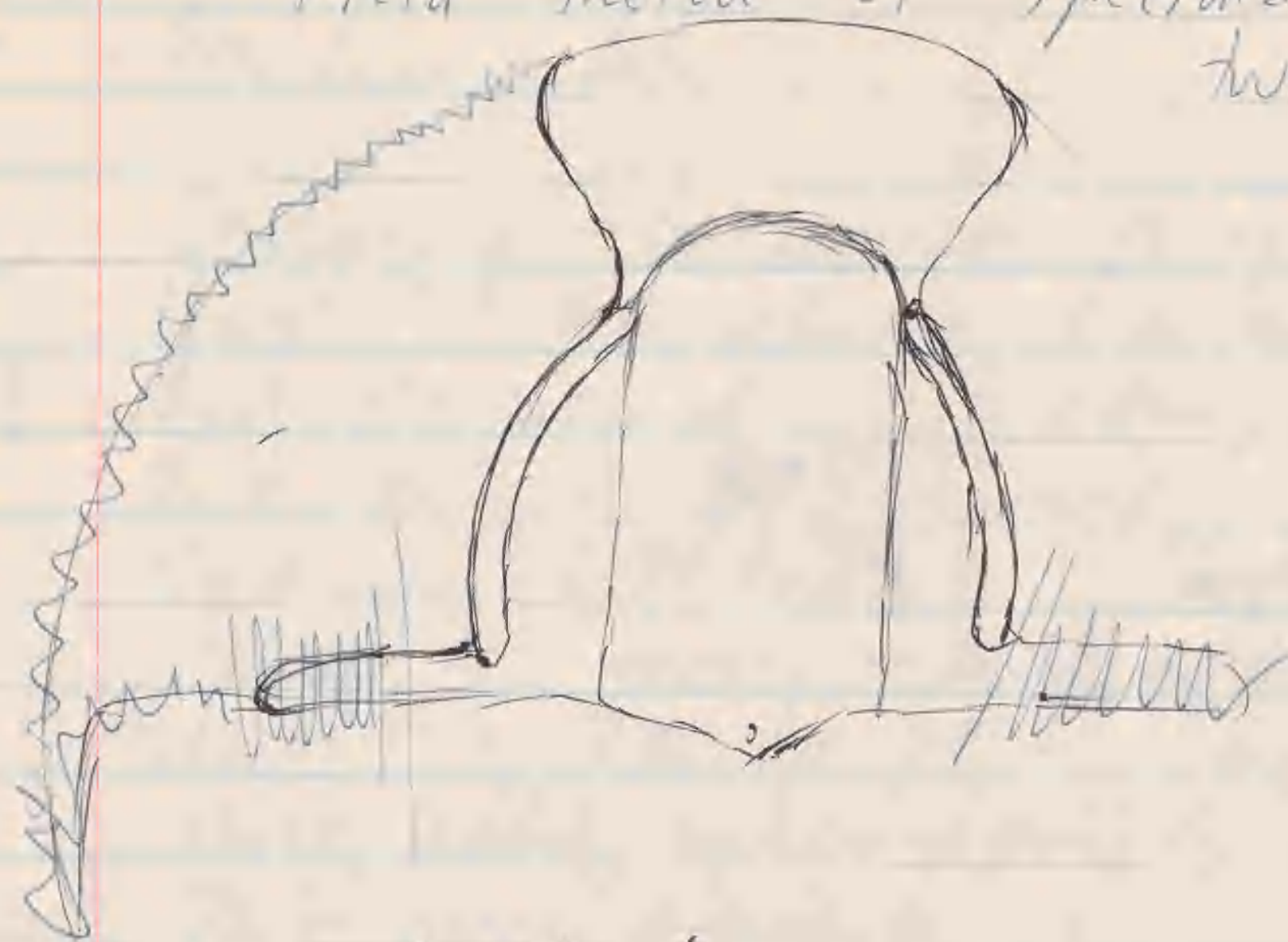
Unit 16 ~~to~~ Sandstone,
approximately 10 feet of pale green-
tan weathering sandstone - may be
displaced by faulting. Significance is
the clay flake content which is
readily obvious - this unit is near
(overlies) the red shale unit - or is
a few feet above it. Area faulted
relationships still bed confused.

Unit 14 - N5°E & 44°SE Good
exposure

Collected some sphenolids at bottom
of formation where a second
hematite - cemented sandstone occurs,
within a few feet of Tapeats
contact.

3/30/71

Field sketch of specimen found by
two young men.



Ed Boyle
172 Swaab Nellis

Milton Smith
28 Cook Circle Nellis

Met the above two young men, about
14-16 years, local high schoolers,
live at Nellis. Offered them \$5.00
if they could show me where I could
collect a specimen of the above

— End of Day —

6/5/71

Frenchman Mtn.

Continuing to measure section of 5/30/71

↑
13
12

Unit 10 - Red weathering ss - beginning at bottom

Unit 11 - 0 to 39 Sandstone, shaly as below

Unit 11a - 0 - ~~67~~⁶² Covered

Unit 12 - ~~67~~⁷⁰ to 72 - ~~Sandstone, shaly~~
shaly green - small outcrop with 5" stringers

Unit 13 - 72' to 75' - Sandstone,
thick bedded, medium grained, beds to 1',
20% green glauconite.

↓
14
15
16
Slope 190

Unit 14 - 75' to 82' - Sandstone, green
shaly with some clay shale

Unit 15 82' to 84' - Sandstone, green
med fine grained, glauconitic hard beds
1' to 3". Trilobite "plowing" trails
1" wide. This is the highest trilobite
noted above red shale except for less
definitive walking trails. N 80° E S P SE

Unit 16 - 84' to -103' - Covered - mostly
green sandy shale.

6/5/71

Unit 17 0 to 10' - Sandstone, tan, ripple bedded, beds 6" thick, contains ~~substantial amount~~ of shale flakes. Bedding draped by nearby faulting.

Unit 18 10' to 15' - Shale, green clay shale

Unit 19 15' to 28' - Red shale, with sandstone stringers to 2" - mostly ss stringers are 1/2" or less. Contains microp ripple marks. Bedding slightly disturbed by drag from nearby faulting.

Slope 10°

Unit 19a 28' to 44' - Shale, green with 30% sandstone strata about 1/2" thick. Five or six dark brown very calcareous sandstones noted in upper half. Brachiopod near 29' - Bicoratorps at 35'. Very fine mica throughout.

Unit 20 28' to 56' - Sandstone, shaley ~~fine~~, similar to above (Unit 19) but w/o carbonate ss and includes more and thicker ss beds to 2". Less mica, shale is more sandy. trilobite fragments, but none identified. Fragments appear to be the large Fremontia ^{N50° E} 56° SE

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Unit 21 0 to 20' Sandstone, shaley begins on a 6" hard, red silicified ss bed - possibly cleaved - covered except for top 5 feet. Unit is yellowish in color

Unit 22 20' to 31' "Hydro" zone 20' to 22' hematite cemented med to coarse grained, well rounded silica sand. 22 to 27 mottled gray to purple well graded pure silica sandstone all well rounded 27 to 31 yellow stained pure quartz sandstone and shaley ss minor mica ~~in~~ bottom foot.

Unit 23 31 to 45 Sandstone shaley, with sandstone strata to 2" shaley partings are irregular. Color - yellowish green

Unit 24 - 45 to 62' Shaley, green to gray ~~is~~ with sandstone strata to 1/2". Trilobite marks abundant. Hysolites at 57 Olewellid type seen at 62' 53° N 10° E

Unit 25 - 62' to 68' "Hydro" zone #2 About 1' of red hematite cemented rock remainder yellow stained or grey. All qtz, ~~not~~ possibly graded unrounded. Red ss contains brachiopods & trilobites

slope 5°
slope 15°

6/5/71

Unit 25 - continued 62-68 -
actual direct thickness of Air zone
maximum of 4' 2' red & yellow ss -
cinderly in qtz, grey poorly cemented.
Brachiopods collected elsewhere.

Unit 26 - 68 to 69 Hard sandstone
in 4" beds, silica cement

Unit 27 69 to 74 - Sandy shale
shaly sandstone, sandy near top more
clay shale near bottom, fine mica

Unit 28 74' to 75' hard sandstone
similar to Unit 26

Unit 29 - 75 to 79 Sandstone, ^{shaly} gray to
purple with minor amount clay shale
poorly cemented, mostly VFC qtz. $N110^{\circ}E\ 51^{\circ}SE$

Unit 30 - 79 to 85' ~~shale~~ sandstone, shaly
yellow zone and sandstone stringers.

Tapeats ss - contact covered.

6/5/71

Measuring Tapeats, Fremont off set
slightly down above line

Unit 1 - 0 to 100' ^{sandstone hard} Slope 16°
 $N7^{\circ}E\ 57^{\circ}$ at top - purple "marker"
bed, about 2' thick at 71 to 73±

Unit 2 - 0 to 26' - Sandstone hard
dip $N25^{\circ}E$

Unit 3 - 26' to 28' Sandstone, low
hard, weathers to sandy surface, yellow

Unit 4 28 to 36 Sandstone,
poorly cemented weathers to sand, gully
unit mostly covered. This unit is
mostly, purple gray med to coarse almost
all qtz.

Granite.

At South power line section, measured
down hill from "Hydro" zone to "Hydro" zone
#2 50' @ 9° . Hydro zone #2 dip about 45° ,
"Hydro" #2 top about 4' above hard zone
Sandstone #1. Hematite cemented sandstone
contains brachiopods (none collected) and includes
3-4 mm fragment of vfg silty rock of various
colors - pale gray, pink, "white" etc.

↑
slope
23

↓

6/6/71

Frenchman Mtn
to check points on section from
powerline north.

① Check of wash bottom measurement

190
140
150
50

Unit 1 - 0 to 85 - Covered

Unit 2 - 85 to 87' - Shale green sandy

Unit 3 - 87' to 104' - Sandstone, tan
N21°E 46°SE

Slope 3° Unit 4 - 0 to 26' - Sandstone, red
N24°E 48°SE

Slope 40 Unit 5 - 0' to 6' - Sandstone, shaley,
green micaceous. Appears to be an
erosion at surface - red ss bed about 1'
thick deposited in green ss.



Unit 6 6' to 11' - Sandstone, red,
shaley

Unit 7 11' to 20' Sandstone, red
with green shale interbedded. Shale flake inclusions.

6/6/71

Unit 8 20' to 32' Shale, green
clayey with mica.

Remainder of section is covered.

On powerline hill north

Unit 1 - 0' to 10.5' - Covered, green
shale at last few feet. Slope 24°

Unit 2 - 0' to 19' - tan sandstone
slope 14°

Unit 3 19' to 45' - Sandstone red -
looks reworked. Slope 14°

Unit 4 0' to 38' - Deep red ss - an
in contact with tan ss at wash bottom
partly covered. Slope 15° Dip 49°
This is not known to be bottom of red
ss. - remainder of section covered.

Over

6/6/71

Rechecking published section

Unit 1 - 0' to 58' - Covered, green shale in lower few feet. Slope 23°

Unit 2 - 0' to 18' Sandstone, tan Dip 54°

Unit 3 - 18' to 52' Sandstone, red "reworked" -

Unit 4 - 52 to 56 Sandstone, green shaly

Unit 5 56' to 78' Sandstone deep red. Dip 45° Slope 26°

Unit 6 - green shale

on published section

Measured from top of "Hydro" zone #1 to top "Hydro" zone #2 Slope 8° distance 50 feet Dip 45°. Pit from which "Lower" trilobite zone collections were made is on upper edge of "Hydro" #2. "Hydro" 2 contain brachiopod fragments.

not collected brachiopod in float & base of "Hydro" zone

↑ slope 26°

↓

6/6/71

Rechecking near Diceratops site at trash dump.

Bottom of Albertella section Unit 1 - 0' to 20' Sandstone, tan

Dip 54° Unit 2 20' to 40' Sandstone red & tan

Unit 3 40' to 83' Sandstone red Dip about 43°

Unit 4 green shale

← slope 25° →


~~Unit 3 - 0' to~~

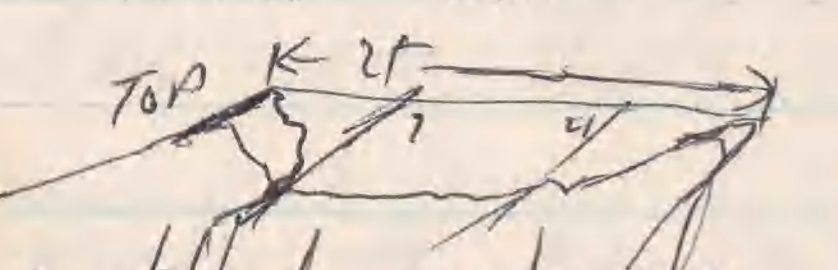
6/8/71

Sheep Mtn:

- ① Carbonate beds - are detrital rock, very fine grained, well sorted, gtz sandstones and siltstones, with abundant carbonate cement. Actual carbonates are only 1 to 2" thick - total carbonate-carbonate cemented clastics = 1' to 4"
- ② Alberella collected above true weathering sandstone
- ③ Top 6' of Bright Angel - ridge is oolite - actually bottom part of carbonate structure.

Beginning measure of "Lyden"

Unit 1 - 0' to 25' "bin" 
Attitude N40°W Dip 30°SE
Grey limestone with thin carbonate trilobite bed at top.

Unit 2 - 0' to 25' 
hard dk grey - orange mottled carbonate
0' to 7' (5' direct); Covered 7' to 21';
all grey carbonate 21' to 25'; N35°W Dip
true slope 1° down, cross dip, 35°

Unit 3 - 0' to ^{44'} ~~69'~~ line slope 26°
down cross dip.

0' to 13' - Carbonate grey w/ yellow + gray
band - ripple. (11' 8" - direct measure)

13' to 24' Carbonate mostly grey medium
grey Strike N35°W 34° NE

24' to 32' Grey (dk) Carbonate, hard
ledge former - same attitude as above

32' to 44' - Sandy, carbonate mottled
pale grey, and ~~white~~ dark spots, yellow
seams

↓ Unramped canyon

Unit 4 - Direct measure on dolite 11'
Direct measure on ledge to - 9'

6/14/71
At Sharp Mountain to check problems
in Seefers measurement and recheck
of 6/11/71

1. Checking base of Bright Angel.
Contact at bottom of red coarse grained
sandstone with abundant vertical
worm boring (weathering out) and
grey sandstone

Unit 2 } 0 to 72 - line slope 1° up hill
through } 0 to 8' - Red sandstone Dip 24°
Unit 3 } 5 to 11 - pale grey ss with yellow, Dip 25°
bed ripple marked on top
11' to 55' - Green shale topped by
4" purple sandstone bed
55' to 70' - yellow green shale
70' to 72' - Sandstone rib with brown
Dip 28° Carbonate all beds 1" ±

Probably fault between 55' + 70' which decreases
thickness by estimated 10' say 55' to 60' fault 60 to 85'
yellow green shale

Unit 7 - 0 to 45° line slope 5° down
Dip 35° yellow green shale unit

Unit 14 - Scolither rocks to coarse
valley ss and red shale. Scolither dip 19° -
Tan ss dip 32° - mid way - Coarse ss dip 33°
0' to 48 tan ss 48 to 72 green shale, purples + rough ss,
line slope
30° down

6/14/71

Unit 15 ^{Deep} Red Shale - Dip 38°

Unit 16 Red SS & Shale Dip 38°

Unit 17 Tan sandstone Dip avg. 45°

Chisolm Section Measurement
Top down - Contact obscure

line
slope
24°

0 to 13' Covered
13' to 20' Green shale approximate
20' to 40' Limestone roughly thin bedded -
beds 2" to 6" - yellow-mottled-white,
dark grey sand, silt, oolites & other
organic matter Dip 25°

40 to 55' - Green shale mostly covered

line
slope
11°

55 to 99 - Lydon top covered
about 29-32 - red shale
0-5 oolitic sandstone yellow
32-36 sheared Assume dip 25°

Rough measure Lydon down
0 to 32 32° Dip Red & Green shales
32 Fault - possibly 70 feet cut out
32 to 77 - covered
77 to Brown SS which under lies

6/14/71

green shale & yellow carbonate ss. ^{Brown ss is} ^{imitation}
77 to 105 Covered

line slope 12° down.

Underlain by green shale - presumably
the Albetella zone

6/15/71

Frenchman Mtn.

Measuring from base of red sandstone on Trench line.

- 0 to 40 Red sandstone dip 24° at base
- 40 to 48 Green shale
- 48 to 73 Sandstone glauconitic Dip 30°
- 73 to 80 Shale, green
- line slope 15°

Measuring section along trash wall Lydon - 55° dip

- 1 0 to 162' - Covered line slope 6°
- 2 0 to 21' - Tan sandstone N10°E 51°SE
- 3 21 to 69' - Red & tan sandstone
- 4-1, 4-2, 4-3 0 to 55' - Red sandstone line slope 17° up
gray shale bed about 4' thick - 2' above bottom of red ss. ~~N10°E~~ N15°E 58°SE
- 5 0 to 39' green shale
- 6 39 to 71' covered
- 7 71 to 87' glauconitic ss projected N10°E 55°SE
- 8 0 to 44' Covered
- 9 44 to 50' Glauconitic ss - Direct measure 4' N16°E 54°SE bed to 2' thick cross bedded

line slope 80° up

line slope 11° up

line slope 10° up

6/15/71

From bottom of 2nd glauconitic ss beds.

line slope 0°	{	0 to 7 - Green shaly ss	Unit 10
		7' to 64' - green shale	Unit 11
		64' top of red shale unit	

off set out of wash bottom to south
beginning at top of 2nd glauconitic ss

line slope 12° down	{	0 to 7 - glauc. ss.	
		7 to 64 - sandy shale + mostly green shale	
13	{	64 to 84 - red shale (shale strikes disturbed by faulting?)	
		84 to 100 - covered	
14	{	0 to 26' - covered	
		26' to 28' - red hematite-cement ss float	
15	{	28 to 45' - yellow shaly float	
		45 to 55 - "hyppo" zone #	
line slope 18° down	{	55 to 73 - yellow ss float	some in place Dip 55°
		73 to 95 - green shale - trilobites collected	
20	{	at 80' w/ Kelley Barton - previously	
		9.5 to 106' Red hematite ss float say 6" to 1' underlain by yellow crumbly poorly sorted ss and some green sandy shale (float).	
line slope 21° down	{	0 to 5 tan deeply weathered micaceous ss	
		5 to 15 hard sandstone spata to 6" w/ softer ss interbedded	Dip 65°
23	{	15 to 25 green shale w/ yellow ss stringers	

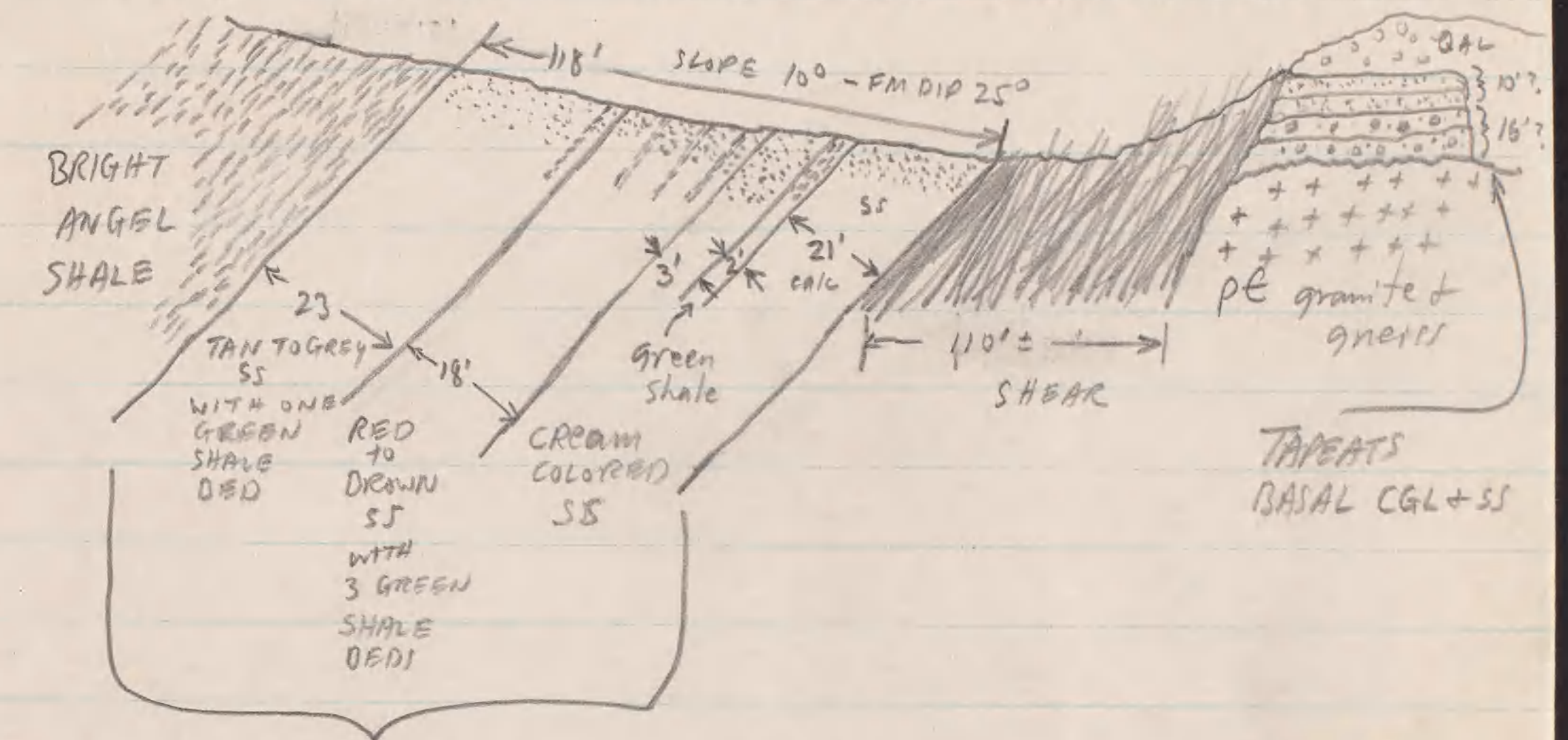
6/15/71

Franchman - measuring Tapes near trash dump.

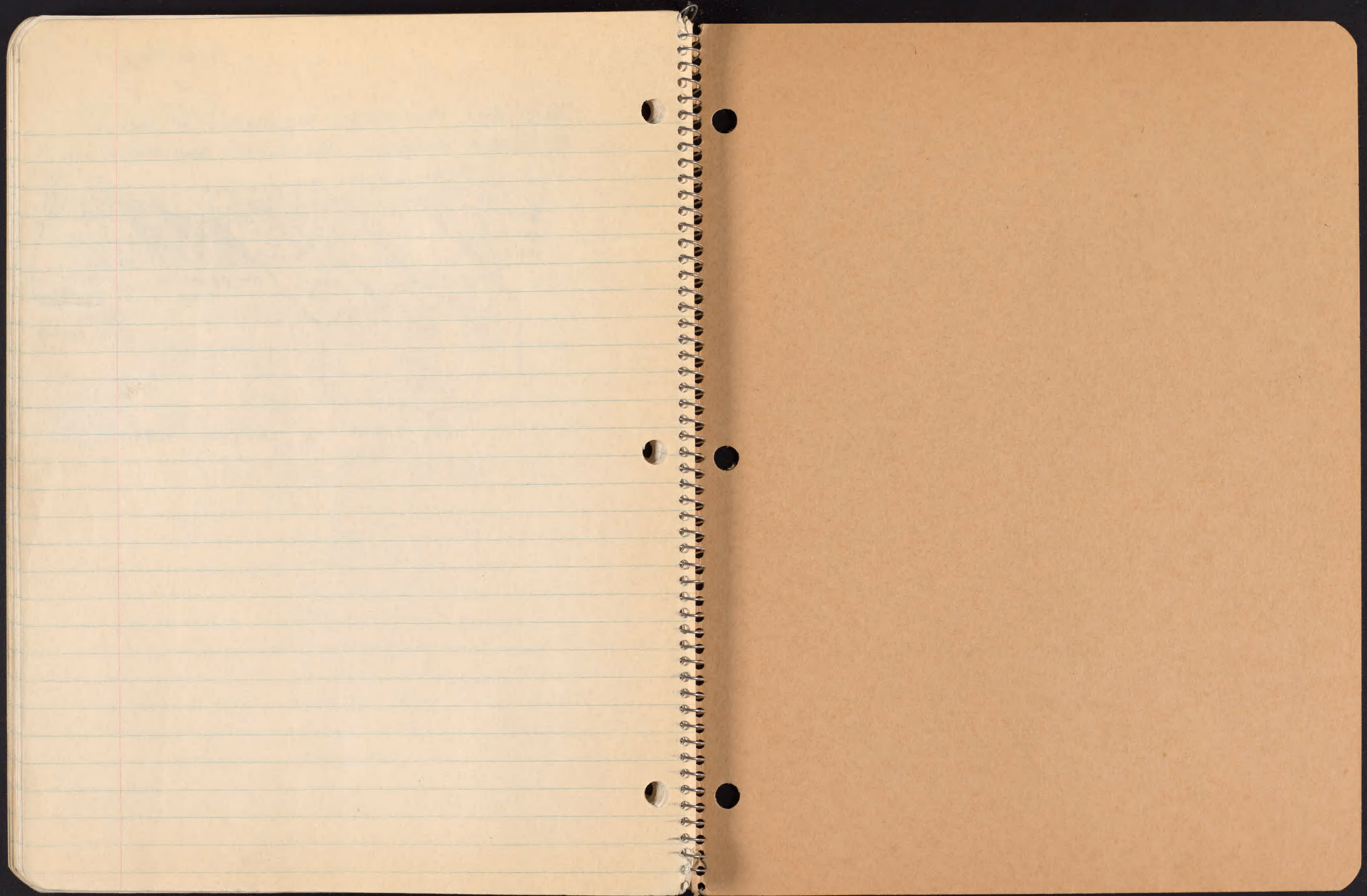
level line	{	0 to 100' Sandstone N50E 55SE - coarse	
		graded sub rounded with ^{100% 90} feldspar fragments - nearly pure quartz	
50° Down	{	0 to 76 Sandstone, quartz, cross bedded	N50E 50SE - weather resistant.
90° Down	{	0 to 18 Coarse pebbly, deeply weathering - poorly cemented at sandstone.	Contact covered here.

5/30/70 9PM VAD

Sketch AND PRELIMINARY CALCULATION OF SECTION AT SHEEP MOUNTAIN USING DATA FROM 5/17/70 etc



67' TAPEATS SANDSTONE + 26'± BASAL TAPEATS



Criscocephalus
with the funny feet
8 pleurae on left - 9 pleurae on right