



**SOKKIA™**

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**TRANSIT  
FIELD BOOK**

No. 8152-00

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## LEO J. HICKEY - LOCALITY LIST FOR THE SUMMER OF 2000

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Waypoint	LJH Loc. #	Date	Name (If Any)	Type of Loc.	Position	Altitude	Stratigraphic Unit	Period/Epoch	Stage	Legal Description	Quadrangle	City/Town	County	State	Country	Remarks
7	0001	07/15/2000	Grimy Gulch	Fossil Plant	N44 52 19.2 W108 44 08.4	5036 ft	Fort Union Fm. (HC)	Paleocene	Puercan	NE2 T56N R99W	Garland 7.5'		Park	WY	USA	Old loc. 7861
8	0002	07/15/2000		Carb. Shale	N44 52 15.3 W108 43 58.6	5053 ft	Fort Union Fm. (HC)	Paleocene	Puercan	NW1 T56N R99W	Garland 7.5'		Park	WY	USA	Carb Sh. w/ poor fossil plants
9	0003	07/15/2000		Field Point	N44 51 40.8 W108 44 42.0	5008 ft	Fort Union Fm.	Paleocene	Tiffanian	C2 T56N R99W	Garland 7.5'		Park	WY	USA	On traverse across ponded beds
10	0004	07/15/2000		Field Point	N44 51 38.9 W108 44 45.2	5027 ft	Fort Union Fm.	Paleocene	Tiffanian	C2 T56N R99W	Garland 7.5'		Park	WY	USA	Rusty micrite
11	0005	07/15/2000		Field Point	N44 51 37.9 W108 44 49.3	5072 ft	Fort Union Fm.	Paleocene	Tiffanian	C2 T56N R99W	Garland 7.5'		Park	WY	USA	On ridge crest w/rusty micrite
12	0007	07/15/2000	Debeya site	Fossil Plant	N44 56 57.5 W108 52 22.2	4619 ft	Fort Union Fm. (HC)	Paleocene	Puercan	C1 T57N R100W	Elk Basin 7.5'		Park	WY	USA	Old loc. 7659 & 7868
15		07/16/2000	Green Bug Reservoir loc.	Fossil Plant	N43 56 45.0 W107 33 50.3	4963 ft	Fort Union Fm.	Paleocene	Clarkforkian	NE19 T46N R89W	Castle Gardens 7.5'		Washakie	WY	USA	A Scott Wing locality
16		07/16/2000	Oil Field locality	Fossil Plant	N44 02 53.9 W107 46 02.1	4418 ft	Fort Union Fm.	Paleocene	Clarkforkian	NE16 T47N R91W	Worland SE 7.5'		Washakie	WY	USA	A Scott Wing locality
21	0008	07/17/2000	Chance locality	Fossil Plant	N45 02 00.1 W109 04 53.1	4056 ft	Fort Union Fm.	Paleocene	Clarkforkian 1	SW19 T9S R22E	Hollenbeck Draw 7.5'		Carbon	MT	USA	Old loc 7132
	0009	07/17/2000	Ginkgo locality	Fossil Plant	N45 04 18.3 W108 51 00.4	4520 ft	Fort Union Fm. (HC)	Paleocene	Puercan	NE12 T9S R23E	Hunters Creek 7.5'		Carbon	MT	USA	Old locs. 72135, 7649, 7423
24		07/19/2000	William Rember home	House	N47 01 56.8 W116 20 16.1	2818 ft				NE33 T43N R1E	Clarkia 7.5'	Fernwood	Benewah	ID	USA	
	0011b	07/20/2000	Emerald Creek #2	Fossil Plant	N47 01 59.3 W116 20 19.2	2822 ft	Latah Fm.	Miocene	15 ma	NE33 T43N R1E	Clarkia 7.5'	Fernwood	Benewah	ID	USA	
26	0012	07/20/2000	Juliaetta locality	Fossil Plant	N46 31 17.5 W116 44 53.7	963 ft	Latah Fm.	Miocene	16.5 ma		Green Knob 7.5		Latah	ID	USA	Univ. of Idaho Paleobotany loc. P-6
27	0011c	07/21/2000	Emerald Creek #3	Fossil Plant	N47 01 58.5 W116 20 18.5	2822 ft	Latah Fm.	Miocene	15 ma	NE33 T43N R1E	Clarkia 7.5'	Fernwood	Benewah	ID	USA	
28		07/21/2000	Hobo Cedar Grove	Botanical	N47 05 09.0 W116 06 46.9	4455 ft					Grandmother Mt. 7.5'		Shoshone	ID	USA	Virgin Forest
29	0013	07/22/2000	Fossil Bowl	Fossil Plant	N46 59 30.9 W116 16 28.6	2896 ft	Latah Fm.	Miocene	15 ma	C13 T42N R1E	Clarkia 7.5'	Clarkia	Shoshone	ID	USA	Univ. of Idaho Paleobotany loc. P-33b
30	0013b	07/22/2000	Fossil Bowl	Fossil Plant	N46 59 29.3 W116 16 33.9	2895 ft	Latah Fm.	Miocene	15 ma	C13 T42N R1E	Clarkia 7.5'	Clarkia	Shoshone	ID	USA	Univ. of Idaho Paleobotany loc. P-33a
31	0013c	07/22/2000	Fossil Bowl	Fossil Plant	N46 59 29.4 W116 16 33.8	2889 ft	Latah Fm.	Miocene	15 ma	C13 T42N R1E	Clarkia 7.5'	Clarkia	Shoshone	ID	USA	
32		07/22/2000	Bechtel Butte	Waypoint	N46 59 28.8 W116 19 07.1	4615 ft				N15 T42N R1E	Clarkia 7.5'		Shoshone	ID	USA	
34	0014	07/25/2000		Viewpoint	N45 08 04.1 W109 03 36.5	4342 ft	Fort Union Fm.	Paleocene		SW17 T8S R22E	Belfry 7.5'		Carbon	MT	USA	
36	0015	07/25/2000		Field Point	N45 08 31.2 W109 04 07.2	4194 ft	Fort Union Fm. (CM)	Paleocene	Tiffanian Ti4	NE18 T8S R22E	Belfry 7.5'		Carbon	MT	USA	
37	0016a	07/26/2000	Millenium Notch Section	Field Point	N45 08 41.7 W109 03 49.2	4187 ft	Fort Union Fm. (CM)	Paleocene	Tiffanian Ti4	NE18 T8S R22E	Belfry 7.5'		Carbon	MT	USA	Base of section
38	0016b	07/26/2000	Millenium Notch Section	Field Point	N45 08 45.6 W109 03 50.2	4324 ft	Fort Union Fm. (CM)	Paleocene	Tiffanian Ti4	SE7 T8S R22E	Belfry 7.5'		Carbon	MT	USA	Top of segment
39	0016c	07/27/2000	Millenium Notch Section	Field Point	N45 08 33.2 W109 04 07.4	4152 ft	Fort Union Fm. (CM)	Paleocene	Tiffanian Ti4	NE18 T8S R22E	Belfry 7.5'		Carbon	MT	USA	Start of segment
40	0016d	07/27/2000	Millenium Notch Section	Field Point	N45 08 39.0 W109 04 13.5	4348 ft	Fort Union Fm. (CM)	Paleocene	Tiffanian Ti4	NE18 T8S R22E	Belfry 7.5'		Carbon	MT	USA	Top of segment
41	0016e	07/27/2000	Millenium Notch Section	Field Point	N45 08 47.1 W109 04 32.0	4331 ft	Fort Union Fm. (CM)	Paleocene	Tiffanian Ti4	CS7 T8S R22E	Belfry 7.5'		Carbon	MT	USA	Start of segment
42	0017a	07/28/2000	Westward Ho! Section	Field Point	N45 08 06.8 W109 02 51.9	4160 ft	Fort Union Fm. (CM)	Paleocene	Tiffanian Ti4	SE17 T8S R22E	Belfry 7.5'		Carbon	MT	USA	Base of section
	0018	07/29/2000		Photo Point		5050 ft	Ft. Union/Hell Cr. Bdy.	Cret.-Tertiary	Maestr.-Puercan	SE31 T57N R98W	Garland 7.5'		Park	WY	USA	Old loc 7862
	0019	07/29/2000	Grimy Gulch	Photo Point	N44 52 19.2 W108 44 08.4	5036 ft	Fort Union Fm. (HC)	Paleocene	Puercan	NE2 T56N R99W	Garland 7.5'		Park	WY	USA	Old loc. 7861
43	0020	07/29/2000		Vert. Loc	N44 59 41.3 W108 56 49.2	4389 ft	Fort Union Fm. (BM)	Paleocene	Tiffanian Ti4	CWB21 T58N R100W	Elk Basin NW 7.5'		Park	WY	USA	Start of stratigraphic traverse
44	0021	07/29/2000	Time Warp Gulch	Field Point	N44 59 30.1 W108 57 14.7	4518 ft	Fort Union Fm. (BM)	Paleocene	Tiffanian Ti4	C20 T58N R100W	Elk Basin NW 7.5'		Park	WY	USA	End of stratigraphic traverse
46	0022	07/29/2000	Sand Coulee Prospect	Viewpoint	N45 00 17.0 W109 01 54.1	4484 ft	Fort Union Fm. (CM)	Paleocene	Tiffanian Ti4	SE33 T9S R22E	Hollenbeck Draw 7.5'		Carbon	MT	USA	
	0023	07/29/2000	Westward Ho! Extended	Field Point		4300 ft	Fort Union Fm. (CM)	Paleocene	Tiffanian Ti4	CS17 T8S R22E	Belfry 7.5'		Carbon	MT	USA	Stratigraphic traverse
47	0024	07/30/2000	Chance Section	Field Point	N45 00 29.2 W109 02 05.4	4211 ft	Fort Union Fm. (CM)	Paleocene	Tiffanian Ti4	SW33 T9S R22E	Hollenbeck Draw 7.5'		Carbon	MT	USA	Base of section
48	0025	07/30/2000	Baseball Hill	Fossil Plant	N45 00 21.9 W109 02 33.5	4290 ft	Fort Union Fm. (CM)	Paleocene	Tiffanian Ti4	SW33 T9S R22E	Hollenbeck Draw 7.5'		Carbon	MT	USA	Old loc. 8029
53		08/01/2000		Waypoint	N42 05 59.5 W110 30 24.3	7156 ft				CN6 T24N R115W	South Fork Mountain 7.5'		Lincoln	WY	USA	Vehicle parking place
ASPEN	0026	08/01/2000	Aspen Shale Locality	Fossil Plant	N42 05 59.3 W110 30 07.4	7100 ft	Aspen Shale	Cretaceous	Albian	CN6 T24N R115W	South Fork Mountain 7.5'		Lincoln	WY	USA	Old loc. 9918; suffixed a,b,c
CHANCE	0008	07/24/2000	Chance locality	Strat. Section	N45 02 00.1 W109 04 53.0	4056 ft	Fort Union Fm.	Paleocene	Clarkforkian 1	SW19 T9S R22E	Hollenbeck Draw 7.5'	Chance	Carbon	MT	USA	
EMERALD1	0011a	07/20/2000	Emerald Creek #1	Fossil Plant	N47 01 59.6 W116 20 19.6	2865 ft	Latah Fm.	Miocene	(15 ma)	NE33 T43N R1E	Clarkia 7.5'	Fernwood	Benewah	ID	USA	Univ. of Idaho Paleobotany loc. P-37
FONTINELLE	0027	08/02/2000		Prospect	N42 05 40.5 W110 29 52.0	7530 ft	Aspen Shale	Cretaceous	Albian	NE6 T24N R115W	Fontinelle Gap 7.5'		Lincoln	WY	USA	
KEMMERER		07/31/2000	Town of Kemmerer	Waypoint	N44 52 18.9 W108 44 08.2	7007 ft						Kemmerer	Lincoln	WY	USA	







Loc. 0001

~~7/15/00~~ 7/15/00

Grimey Gulch PLANT  
16c revisited.

FORT UNION Fm - Lebo Mbr.

GPS. N  $44^{\circ} 52.316$

W  $108^{\circ} 44.137$

Waypoint 007

This 16c is in the  
attenuated portion of  
The Lebo member above  
The prominent *Phacelasma*  
*ity*. Found in The  
Grimey Gulch section.

~~Doq~~  
P

ACTUAL PIT IS AT

N  $44^{\circ} 52.320$

W  $108^{\circ} 44.140$

PLATANoids several sp  
Other unknown angios.  
WOODWARDIA grisea  
Glyptostrobus  
Metasequoia

INSECT DAMAGE TO  
PLATANoids.  
(P. raynoldsii)

LOC 002

WAYPOINT

008

carb shale w plants  
flags on track on  
e side of MANTUA  
Gulch

Loc. N 44° 52.255'

W 108° 43.976'

looks like a pond in a  
mire w fissle grey  
paper sh.



7/15/00

START of TRAVERSE

SW SEC 2 T 5 N R

WAYPOINT 009

LOC 003.

going WEST TO  
see if cross lake beds.

004

010

ON RUSTY ls. of  
Sec. 86 ~~at~~

Rusty MICRITE w.  
UNIT THAT IS OTHER  
like the Tfuf

005 Ridge crest  
w/ RUSTY MICRITE  
JUST below contorted  
SS on ridge top.

7/15/00

006 End of Traverse

No Belfry mbr here

Some widespread,

channel shallow

channel ss. &

at least 3 ferruginous  
micrite layers

But interval is one of

soils & soil horizons

comparable to normal

fluvial member.

It is interesting that

waypoint 0612

N 44° 56, 957'

W 108° 52, 369

at Debeva site.

007 Debra Site 7/11/00  
Revisited

WAXPT. 2012

N  $44^{\circ} 56.957$

W  $108^{\circ} 52.369$

GINKGOS IN MATS AT THE  
BASE OF A CLAY PLUG

ALSO OCCURRING  
W GINKGO SEEDS

PLAT. RAYNOLDS

META SEQUOIA OLLIDA

SAMPLED FOR GINKGO CUTICLE



7/14/06

W SCOTT WING & PARTY IN  
WORLDWIDE BIRD AREA  
COLLECTING GINKGO CUTICLE FOR  
DANA BOYER.

Loc. 1 Green Bug  
Reservoir

Cuticle locality in upper  
Fort Union near  
Green Bug Reservoir  
on a north facing slope  
in a carb sh

N 43° 56.749'

W 107° 33.838'

A second cuticle loc. in an  
oil field at

N 44° 02.898'

W 107° 46.035'

visited a third site  
in upper Clarkforkian  
on east side of Hwy 16

e of Durkce about 2 mi

7/17

A short day. Showed  
SCOTT the KIT boundary  
N.E. of Grimy Gulch and  
The gulch loc. itself.

The Grimy Gulch PLANT  
loc is in The Hunt Creek  
member of The Tfu  
CONTRARY to what I wrote  
yesterday.

Returned to B. L. Camp.

008 CHANCE Loc (Revisited)  
old loc 7132

7/17/00

w DANA ROYER

(See 22 p. below for revisit.)

Roadcut on W. side of  
COUNTY LATERAL  
NEAR C W line Sec 19  
T

N45° 02.001

12T 0651127

W 109° 04.884

4988446

loc is 0.2 mi S. of end of outcrop & bend  
of ROAD

Ginkgo seeds

Ginkgo leaves

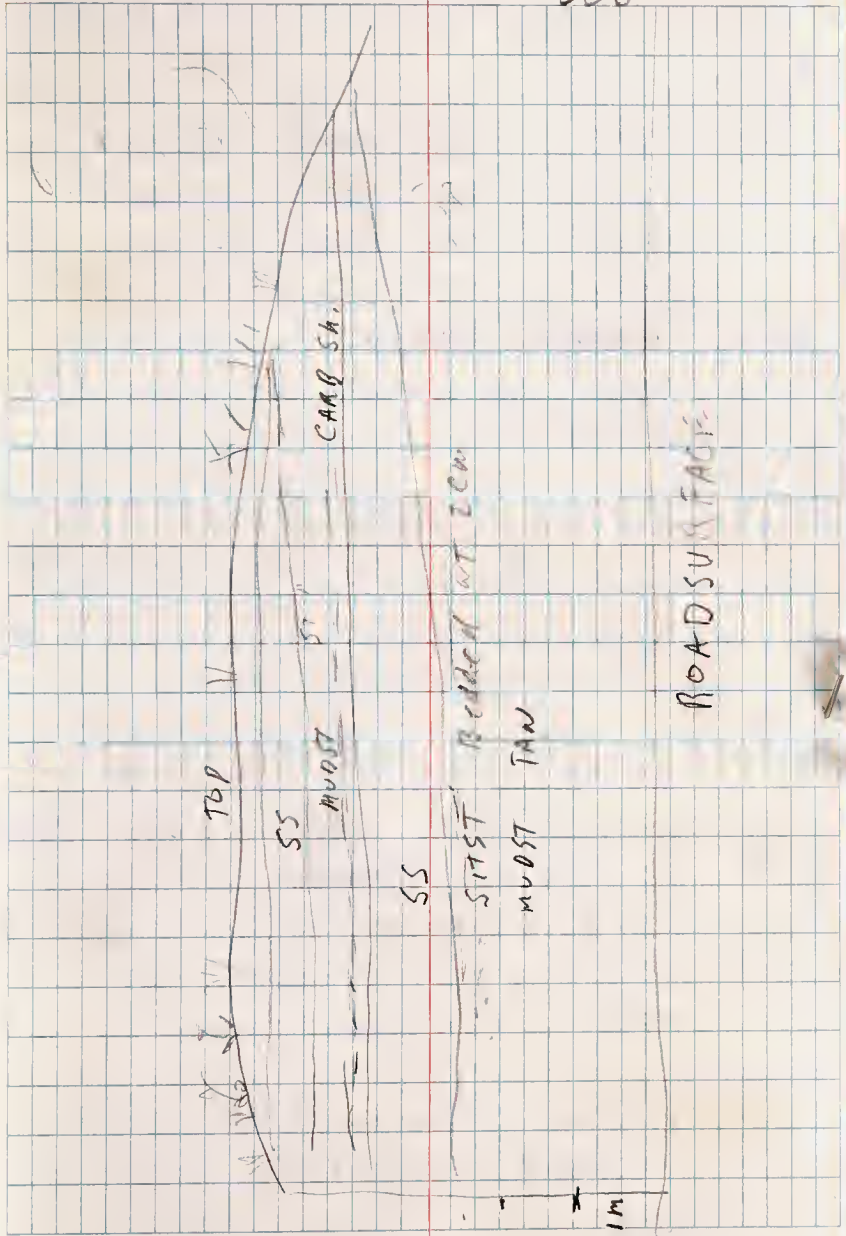
UNKN leaf

MOST PLANT MEM. & LEAVES are  
FRAGMENTARY BUT THE GINKGO  
occurs in larger frags.

THAN ANY OF THE OTHERS

SETTING LOOKS LIKE A DISTAL  
SPRAY SETTING w  
SOILS, MUDS, & SS.  
SPRAY CHANNELS





- (1) Blocky massive mudst Flood plain soil  
2m
- (2) SITST, Laminated w/ comminuted pl. frags & lvs. (see floral list) DISTAL SPLAY (TRANSPORTED FLORA)  
0.10m ~~DISTAL SPLAY~~  
BASE of UNIT w/ worm TRAILS

↑ SS coarsening upw.

SITST

- (3) mudst/SITST interbed, finely laminated, carbonaceous very finely comminuted plant hash SWALE, pond receiving see. floods  
0.15m

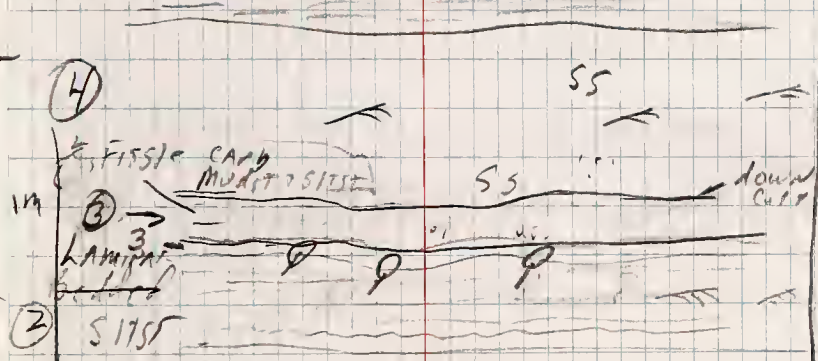
- (4) Ripple laminated splay bedded vfg ss channel  
0.4m

7/18/00

008

(5) - Carb sh /  
 0.40m lignite (SCLT cont on next p.) (cont)  
 BASE of SS ONLY slightly  
 DOWN CUTTING. NOT SCORPED

(5) Carb sh.



THICKNESSES IN ROWS USE  
 MEAS. VALUES IN SECT.

MASSIVE (TAN)

Blocky  
 TAN  
 TO  
 GRAY  
 grey mudst

mudst is a TYPICAL flood  
 PLAIN SOIL MASSIVE  
 Some poor LAMINATION  
 in a few PLACES  
 NO PLANTS. Some gyp



Flora:

Ginkgo

Nordenskiöldia = <sup>Zizyphoides</sup> flabella

Platanus cf. raynoldsii

UNKN leaf. Small

Acer silberlingii

Nardiphyllum daturae-  
folia ??

SECT CONT from prev. page

UNIT 5 grades upw into  
a laminated brownish  
TAN MUDST.

Correlation from Gingenich  
2000 fig. This is  
base of Cf<sub>1</sub>  
which agrees w/  
occurrence of Acer  
Silberlingii

PICTURES  
Roll 2

# 19, 22 Bluffs to e. of C.F. River e.  
# 23 Loc. 008 of CHANCE, MT

009

7/17/00

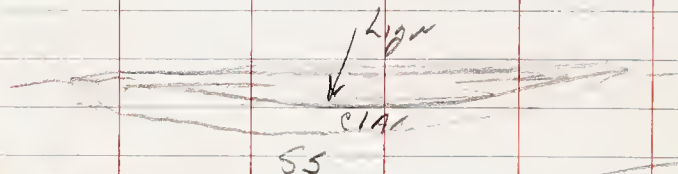
Old Ginkgo site

old 7235

N 45° 04.314' 18.84"

W 108 51.003' 0.42"

150 yds



Channel fill of  
CLAY + lignite TO 1.5 m  
IN CENTER

CLAY below lign  
TOWARD base interbeds of  
SS + CLAY

Some log hash channels  
log on axis of ch.

No ginkgo found  
at all though

IT WAS present right  
AT BASE OF CLAY plug in  
72.

Protophyllum  
Lauvaceae cf. Beilschmidia  
Large leaved member  
PIAT raiwilsii



D10 SW SW Sec 7, T9 S R 24 E  
Hunters Cr. 7 1/2 Quad.

Revisited old site  
76 54, g.v.

CLAY - lign. channel  
fill w leaves just  
above the base of  
the channel.

Channel lies above a  
SS.

7/19/00

To Clarkia Flora site w/  
DANA Boyer.  
Host Bill Bember

WAYPOINT 024

Home built right on  
a Clarkia Flora site

PITS in old road excavation

0011 a

BENNETT Co. Idaho

~~CLARKIA Fm~~

LATAH Fm

~~CLARKIA SITE~~ EMERALD

Cr. SITE #1 AT

1/2 m above a 4'

ASH

AT Bill Rember's House

EMERALD CREEK FLORA #1

EMERALD 1a

50' higher than Rember's  
Thesis FLORA AT THE  
RACE TRACK.

14.5.15

W 47° 01.996'

W 116° 20.332'

WAYPOINT #1 Emerald #1

UNOX OXIDIZED

Rembers P-37

## CLAVATA SITE

- Amens TAXUS

✓  
THIS FOR SIMILARITY  
TO CEPHALOTAXUS

CATHYA IS PRESENT

All modern sp. of PLATANUS  
are RIPARIAN!



7/20/00

UNIV. of Idaho, Moscow  
w/ Bill Bember

looked at Clarkia - BACE  
TRACK FLOOR

Bill Bember - Thesis &  
Publs.

Also looked at Ginkgo  
from UIMN loc P-6

Julietta loc.

T37N, R3W, SW 1/4, Sec. 20

The lithology is a  
~~thick sandstone~~ carb sh.  
w/ conifer beds represent  
a pulse of sedimentation  
Ginkgo lvs. associated  
w/ these

X sand is 15-17 sized  
grains w/ large mica flakes  
on bedding planes

LOOK AT GSA SPECIMEN PAPER  
239

VALC. & TEST. IN THE  
COLUMBIA RIVER

7/20/00

0012 JULIETTA LOC.  
WAPT. 26

N 46° 31.291

W 116° 44.895 962'

LOC P-6 of UNIV. Idaho

Pix. Roll #2 25-28

Ginkgo IN interbedded  
SS & CLAY that represents  
delta foreset beds in  
a lake.

Spicer paper

Rip up CLASTS w  
Tuff are.

21000AY

LAC

CLAY IN ~~DIATOMITE~~

SS

20M

ROADWAY

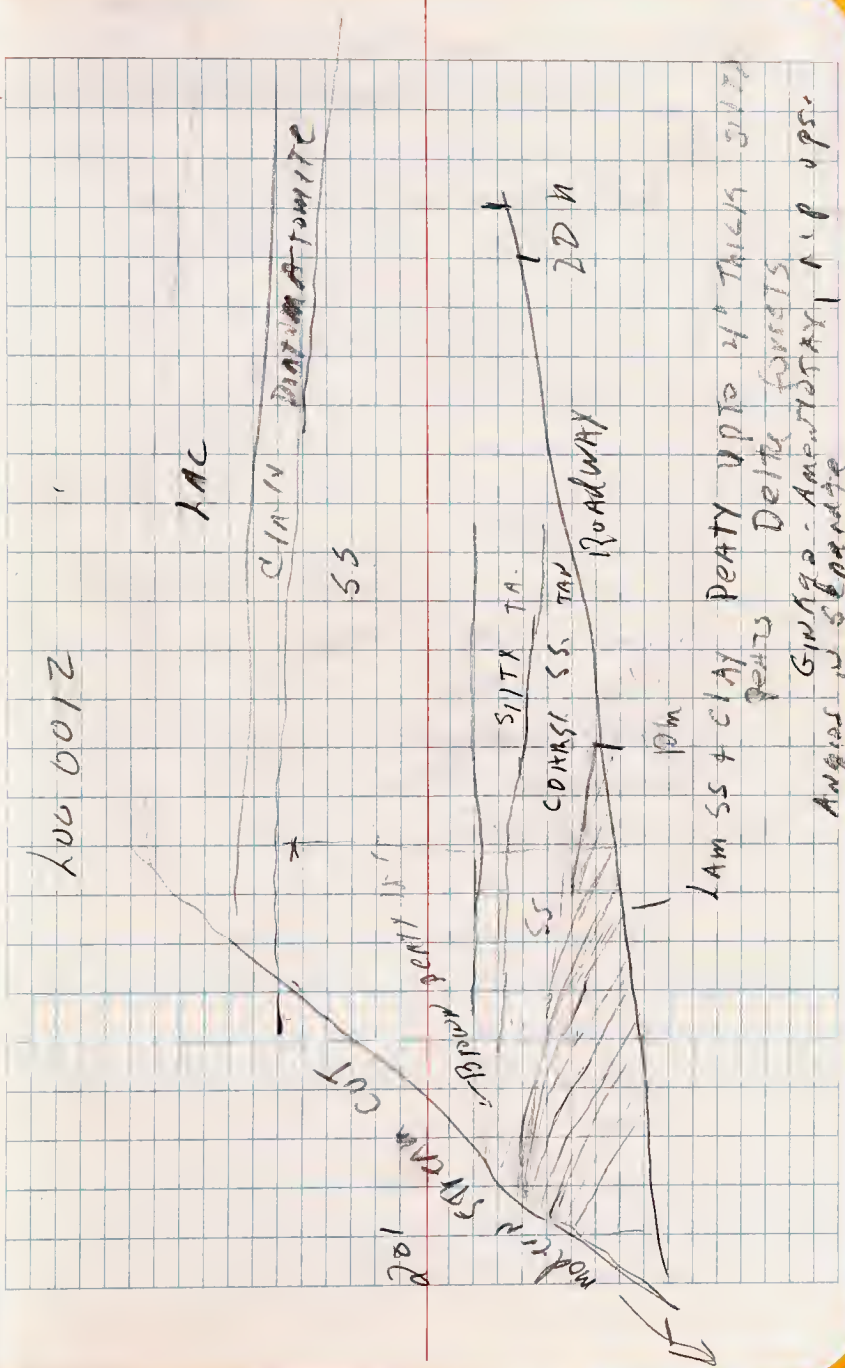
SILT TA.

COARSE SS. TAN

10m

Lam SS + CLAY PEATY UPTO 4' THICK SILT  
PEATS Delta FORESTS  
Gungo. Ameyotay, 1.10 up.  
Angios n. separate

MODERN STREAM CUT  
BROADWAY DEPT. 15'





7/21/00

0011C Emerald Creek.

w Pill Rembers + Dawn Boyer  
Emer Ht

Lower P-37 B

N 47° 01.975'

W 116° 20.308'  
Benewah CO, Idaho

Elev  
2922'

LAURACEAE

CASTANEA

CHAMAECYPARIS cone

Cercidiphyllum

PLATANUS

LITHOCARPUS

CHAMAECYPARIS

Libocedrus

Liriodendron

Liquidambar

ALNUS

UNKNOWN

Salix (very large < 20 cm)

METASEQUOIA

Glyptostrobus

TAXODIUM

Pinus (5' cone)

These are laminated  
lacustrine sands  
that are part of the  
sequence on Bill Hemmers's  
place. all lying at ~  
the same STRAT level  
but w/ somewhat different  
plant assemblages at  
each site.

There is an island of  
PE schist just about  
500' to the east that  
D. Hemmers figures was  
exposed at the time of  
the lacustrine deposition.

7/21/00 Afternoon to  
Hobo Cedar Grove

Wax pt 028

GIANT CLIMAX Forest of

Thuja  
w. *Abies grandis*

see leaflet THAT  
we obtained.

N 47° 05.150

W 116° 06.781

0013 Clarkia Site at  
"Fossil Bowl" 0013

LATAH FM. N 46° 59.514  
W 116° 16.477  
Elev. 2904

LAMINATED (Varved)  
CLAY/SILTST.

WAYPOINT 029

BLACK TO DARK TO LIGHT  
grey in unoxidized  
area

Flora to be listed

SOME lvs. found were  
dull green &  
red dark grp. lvs.  
(some) were red on exposure

Changing to black after  
5 min

SITE lies ~50' below

Emerald Cr. #1 SITE

Sec. W. Member's ash chrow.

Member SITE - 336 "The Pit"



0013 b

P-33a

2' feet below the

1 m thick blue ash

N  $46^{\circ} 59.407'$

W  $116^{\circ} 16.566'$

2897 ft.

WAYPOINT 030

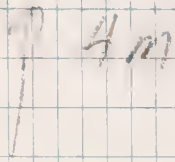
LAMINATED CLAY & SILTST.

0613 C

N 46° 59' 489'

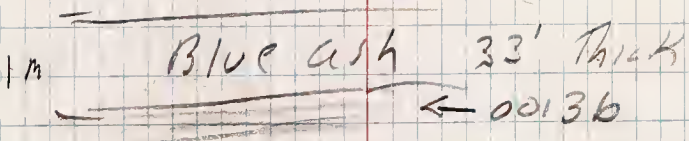
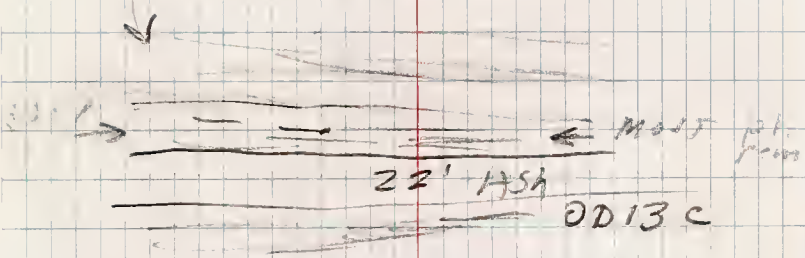
W. P 031

W 116° 16.564'



Elev 2589'

Shales laminated



*Alnus viridis* (Villars) de Candolle subsp. *sinuata*  
 (Regel) A. Love & D. Love -- Sitka Alder  
 Cut at the edge of Bechtel Mountain Road,  
 east of Clarkia, Shoshone Co., Idaho  
 In rich, mixed conifer forest ~3400' elev.  
 L.J. Hickey, s.n. 7/22/2000

008 Revisited  
w/ D. Boyer  
w. Green

7/24/00

Revisited Chance site.

Dip  $6^{\circ}$  W.

Shot detailed STRAT sect

SECTION STARTS AT

Road level. at 0'

DIST.	THICK	DESC.
-------	-------	-------

0.6

Covered

1 0.8

med grey badly wh  
disrupted clayst.

5 x 3/2 some limonite

on partings,

gyp. polsh ~~to~~ at

in upper 2"

2 1.15

SS, fq, SA, quartz

sub arenite

well ind.

w & irreg bedded

at 4-6 cm beds

downcutting at  
base, carb frags  
on bp's w some  
zyp.

LATERAL THE UNIT  
THINS TO 12 TO  
15 m TO NORTH

3 2.7

Sh + clst, w/  
silty beds +  
finely commuted  
plant debris —  
5/5/2

limonite on joints  
zyp on joints

becomes slightly  
silty upward.

IN LAST 0.5 m  
upper 12m is blocky  
(soil).

4 2.8

ffg, sg, clean,  
coarsening upward  
very local trace  
ripple marked.

T

Does NOT extend  
more than 1 m in  
either direction  
(local relief channel)  
Ginkgo occurs in  
this unit  
w/ *Cercidiphyllum*  
5y 5/2

Unit extends less  
than 1 m in total  
+ Ginkgo, *Platanus* (ellii)  
+ *Cercidiphyllum* seedling  
Very small relief  
channel.

5 2.95

SITST, laminated  
w/ pl frags 5y 5/2

6 3.14

SS, vfg, sal, subts  
quartz, subgray w.  
vfg at base  
fg at top  
5y 6/2



MASSIVE w / poorly  
defined bedding  
& plant frags in  
lower 3 cm  
UNIT extends 4-5  
meters on either  
side of SECTION

7. 3.55

Carb sh & mudst  
(rep. a mire  
soil)

some jarosite  
on joint.

poor  
inceptical

→ 5 y 4/2

& rhizomorphs  
& filaments

blocky, mottled w/ jar.

4.2

Top of SECTION  
covered inter-  
val above this

---

UNIT 7 gray pockets  
of charcoal  
prob. representing  
tree trunks or  
ROOTS

PX Roll 3

31-32 - Ginkgo lens  
at The Chance  
loc 008 (7124/00)

33-36 Chance / Belfry  
mhr CONTACT  
looking EAST INTO  
bluffs above Chance  
from loc. 008

0014

SW 1/4 Sec 17, T8S R2E  
Carbon Co.

W.P. 034

N 45° 08.069'

W 109° 03.609'

elev. 4342

View point at Top of  
lac.

concret SS in bluffs to  
N across Trib of  
Bear Creek

in SW Sec 8 & SE Sec 7

0015

WP 36

12T 0651841

UPM

5000540

LAC. ST RIME

CHANCE M50

Ripples on upper part

surf. of

BRUNTO W

SET 15° W

320°

335°

325°

315°

318°

SECT 0016 a  
Millenium Notch SECTION

STARTS AT W.P. 037

Lat 065 22 28  
500 08 74

UPM.

N 45° 08.696'

Elev. 4187

W 109° 03.819'

Top of Pediment. sloping  
S to Wolf Creek

#	I	Th.	Descr
0	0		SECTION STARTS AT TOP of pediment in a The top of the (new) Belfry Mbr. transitional beds.
1	0.3	0.3	SS, friable, med gr. w/ SA, lathy, & PI frags mostly covered 10YR 6/6
2	0.8	0.5	shale, carb w PLANT FRAGS, 10YR 6/2, 10YR 5/2 w/ limonite
3.	1.2	0.4	Mudst, blocky, 10YR 5/2



Sect 0016

Possible marl. (will  
test w HCl)

- |   |     |     |   |
|---|-----|-----|---|
| 4 | 2.0 | 0.8 | Carb sh as at #2<br>grading upw to<br>a siltst.                           |
| 5 | 3.1 | 1.1 | Sh, 10YR 6/4 grading<br>upw to siltst at<br>2.75 and back<br>to sh at 2.9 |
| 6 | 5.8 | 2.7 | Mudst blocky<br>yell. grey<br>becoming carbonaceous<br>in last 15 cm.     |
| 7 | 6.8 | 1.0 | SS, platy, f.g., SA,<br>clayey, 10YR 7/4<br>forms small ledge             |
| 8 | 7.4 | 0.6 | Mudst, chippy, yell<br>grey, w/ gyp.                                      |
| 9 | 8.3 | 0.9 | SS as at #7   |

SECT 0016

			Becomes a SITST above 8.1
10	10.8	2.5	Mudst grey yell green Chippy CLAYST do above at 10.5 m
11	12.1	1.3	SITST, 10YR 6/2 w limonite staining at <del>top</del> from 11.6 - 11.9
12	13.5	1.4	Mudst, Chippy <del>yell</del> 10YR 6/2
13	14.2	0.7	SITST, 10YR 6/2 Some thin beds of vfg, dirt, SA, SS
14	14.3	0.1	Vfg, SA, dirty SS. platey, a lens extending abt 5 m to S. 10 m north.
15	15.7	1.4	SITST as in UNIT #13 becomes carbonaceous

Sect. 0016

toward top

- |    |       |      |   |
|----|-------|------|---|
| 16 | 16.6  | 0.9  | Sh, br. grey, some limonite ST. on JOINTS CARBONACEOUS IN UPPER 10 cm |
| 17 | 17.8  | 1.2  | Mudst, blocky, gypsiferous, yell br +                                 |
| 18 | 18.1  | 0.3  | SILTST, yell grey lent!   |
| 19 | 19.1  | 1.0  | Mudst, silty, chippy, 10% AG/2  |
| 20 | 21    | 1.9  | Shale, 10% AG/2 some thin <del>5</del> 5 cm carb. beds. gypsiferous   |
| 21 | 22.25 | 1.25 | Mudst, calc, grey, platy. slightly calc to mod calc                   |

22	24	2.0	<p>Chance Mbr.  Council ss.  Jedge of fg, SA,  dirty, ripple bedded  ss. well ind.  Flaggy w ripple  sets organized  w tabular surfaces  24'</p>
23	28.7	4.7	<p>24 Top ss lower ss  Calc shale, yell.  grey. some br.  CARBONACEOUS layers</p>
24	32.7	4.0	<p>Upper Council ss.  fg, well ind, SA,  dirty  parallel bedded at  base pec. columnar  bedded toward  top. just to  north (10m) thickens  to a channel facies  becomes more  normally tabular  20 m S</p>



0016

- |    |       |      |   |
|----|-------|------|---|
| 25 | 34.8  | 2.1  | SILTST, w ss (vfg)<br>interbeds.<br>highly calc<br>yellow grey  |
| 26 | 37.4  | 2.6  | PLATEY marl<br>yell grey.<br>w brownish<br>carb band at<br>35.4 - 35.6<br>marl yell. grey<br>and platey.<br>Top 20 cm<br>limonite stained |
| 27 | 38.2  | 0.4  | Shale, med<br>grey w/ pl<br>frags.  |
| 28 | 38.7  | 0.5  | carb sh w<br>pl frags.<br>brown below   |
| 29 | 41.15 | 2.45 | Chippy marl<br>as at UNIT # 26  |



- |    |      |     |   |
|----|------|-----|---|
| 30 | 41.2 | 0.5 | SS, vfg, dirty, st ripple bedded                                  |
| 31 | 42.5 | 1.3 | Marl as at #26  |
| 32 | 43.4 | 0.9 | Lignite on 3 cm of rusty brown rooted siltst.                     |
|    |      |     | <del>43.4 Carb MU</del>   |
| 33 | 45.2 | 1.8 | Mudst, carb, w plants, lvs, roots sticks, old soil. <del>th</del> |
| 34 | 46.8 | 1.6 | Marl (calc mudst) yellow grey chippy to platy                     |
| 35 | 48.1 | 1.3 | Ledges of vfg ripple ss to 10-15 cm interbedded w marl            |

End of Sect  
at W.P. 38

0016b

Wp. 38

12T 0652203

5000994

clew 4324'

N 45° 08, 761

W 104 03, 836

SECT. WILL START W/ WP

39 = PT. 0016E

Sect. 0016 b (offset) 7/26/00

Shifted to pt 0016 c

at WP 39

w/ D. Hoyer & W. Green

- |     |     |     |   |
|-----|-----|-----|---|
| 30b | 0   |     | Top of UNIT 30<br>Tabular ss.   |
| 31b | 3.2 | 3.2 | Marl as in 0016 a<br>10 yA 7/2<br>Chippy into flat<br>pl chips, poor<br>pl frags w/<br>limonite st.<br>top 15cm of marl<br>becomes blocky<br>w limonite st. |
| 32b | 3.9 | 0.6 | modst clayst, chippy<br>med 5/6/1<br>with becomes carbon-<br>aceous in streaks<br>& thin beds above<br>3.4 with marl<br>appearing at 3.7                    |
| 33b | 5.8 | 2.0 | Marl, chippy to platy<br>w/o pl. frags 10 yA 7/2  |

80166

- |     |     |     |   |
|-----|-----|-----|---|
| 34b | 6.2 | 0.4 | SS, vfg, SA, dirty<br>lithic subgrained<br>well ind ledge<br>downcutting at<br>base 10-25 cm<br>Trough x-bedded<br>in upper 1/2 m.<br>ripple & wavy<br>bedded at base |
| 35b | 6.8 | 0.6 | PLATEY mudst<br>10YR6/2   |
| 36  | 7.8 | 1.0 | Silty Marl 10YR6/2<br>becomes a plain<br>SITST above 7.2m   |
| 37  | 8.0 | 0.2 | TO SITST, 10YR6/1<br>Blocky wh.<br>B horizon for<br>units above   |
| 39  | 8.1 | 0.1 | SITST, Blocky<br>roofed, 5YR7/2<br>A horizon for<br>above   |



39	8.6	0.5	shale, fine chippy N3 becomes interbedded with beds of lign above 8.4
39a	9.0	0.4	Lignite
40	10.4	1.4	Mudst, sl calc, blocky, yell. grey 10 silty marl.
41	11.9	1.5	Mudst, med grey w rhizomorphs & rare pl frags limonite on joints
42	12.8	0.9	marl, platy IT. yell grey
43	14.2	1.4	SS, fg, SA, dirty Some mica. Ledge    bedded and limonite st in basal zone



00166

7/26/00

becoming, 1T yell  
grey ripple  
bedded above  
LH09

- |    |       |      |   |
|----|-------|------|---|
| 44 | 15.3  | 1.1  | marl, platy<br>- beds to<br>slope   |
| 45 | 15.9  | 0.6  | micrite in ledge<br>limonite ST and<br>w plant fossils<br>(Reeds) in base<br>10 cm stems. |
| 46 | 19.5  | 3.4  | micrite, silty<br>fms sutter<br>slope   |
| 47 | 20.1  | 0.6  | med grey sh.  |
| 48 | 20.75 | 0.65 | sh, carb, med<br>dark grey  |
| 49 | 21.3  | 0.55 | lignite   |

50 21.8 0.5 X-SS ledge, PLATCY  
f. f., SA, dirty.  
# flappy

51 22.6 0.8 Marl, TAN, PLATCY  
PARTIALLY COVERED.

52 23.2 0.6 SS, vfg, SA, dirty  
friable w some  
cemented edges  
PLATCY, ripple  
marked

53 24.2 1.0 SITST ferruginous  
grading up / above  
23.4 to drk olive  
grey ~~st~~ chippy  
SITST.

54 24.5 0.3 nodular micrite

55 28.1 3.6 marl, silty, blocky  
yellow tan

56 29.7 1.6 SS, vfg, SA, dirty  
platcy, friable

00166

7/26/00

forms thin ledges  
internally  
obscurely ripple  
bedded toward  
top

- |    |      |     |  |
|----|------|-----|--|
| 57 | 31.3 | 1.6 | Marl, yell grey<br>SILTY, CHIPPY                             |
| 58 | 32.1 | 0.8 | carb sh, dk grey<br>PARTIALLY COVERED                        |
| 59 | 32.8 | 0.7 | Marl, SILTY,<br>yell' grey.                                  |
| 60 | 33.2 | 0.4 | Shale, carb<br>dark yell grey                                |
| 61 | 36.5 | 3.3 | Marl as AT#62  |
| 62 | 37.5 | 1.0 | SS, ledgy,<br>ripple bedded<br>in tabular<br>sets ~ 1" thick |
| 63 | 40.7 | 3.2 | Marl, IT yell<br>TAN, SILTY.                                 |

64 41.8 1.1 SS, Vfg, SA, well  
cemented, flaggy  
ledge This SS a  
flaggy lens  
trailing N x NW

SECTION offset  
forward over a  
dip slope  
begins again in  
UNIT 66

63b 39.0 0 Marl

64b 39.4 0.4 SS, <sup>punky</sup> IT grey, becoming  
brownish grey  
upwd.

65 39.6 0.2 Shale, carb.

66 39.8 0.2 SITST, chippy,  
IT yell grey

67 41.4 1.6 Sh, chippy medium  
blue grey some  
carb bands  
becomes lim with ST  
above 40.6



00166

09/26/60

- |    |      |     |   |
|----|------|-----|---|
| 68 | 41.7 | 0.3 | SITST, poorly ind.<br>IT yell grey  |
| 69 | 43.7 | 2.0 | Mudst, Chippel<br>med <sup>th</sup> yell grey<br>w limonite on<br>JOINTS.<br>becomes a carb<br>shale in upper<br>0.7 m. w/ thin<br>lign beds (1/2")<br>med grey<br>some plant frags |
| 70 | 45.8 | 2.1 | Marl med yell<br>grey, PLATEY   |
| 71 | 46.4 | 0.6 | MICRITE, in<br>lenses at this<br>level, wh <sup>th</sup> yell<br>grey brown<br>in a micrite<br>matrix   |
| 72 | 46.9 | 0.5 | <del>MICRITE</del> AS<br>marl as at #70   |



73 52.7 5.8 SS, f.g., SA, dirty  
troughed x-bedded  
channel  
extends only about  
5 m on either  
side of section

50.3 Interbed of  
of SITST, massive  
yell brown

51.7 SS, med to f.g.,  
S1 to SA, dirty,  
ARMOSED, sl. mic,  
ledgy. Top of  
SS channel lens.

74 62.8 10.1 SITST, <sup>marly</sup> thin bedded.  
in tab. beds to  
3 cm., yell grey,  
w/ limonite staining  
joints  
interbeds of marl.  
~~modst~~, lt. grey  
Thin bedded. to  
10 cm.

75 63 75 <sup>Jgs</sup> Thick.  
SS, ledy x bedded  
vfg, SA, dirty.  
flaggy.

Interval between  
this SS & the one  
below has large  
SS channels in  
it w/ Jabba the  
HUT type wh. pattern

α (TOP OF SECTION

Ripple bedded &  
w/ MICRITE  
LENSCS IN TOP.

WAY POINT 40

# Loc 0016 d

N 45° 08. 650

W 109° 04. 225

ELEV 4348

0016 c offset of

MILLENNIUM NOTCH SECTION  
70 W.

Barely covered interval  
SECTION IS AN INTERVAL  
SECTION.

UNIT  
II

DT 0016 c. WP 41

N 45° 08.785'  
W 109 04.533'  
< (ev 433)

76	0	0	<del>covered int.</del>	TOP of 78
	1.5	1.5	ligate	
	<del>3.1</del>	2.6	marl	
	<del>4.7</del>	0.6	ligate	
	9.0	4.3	concl	
	10.1	1.1	marl	
76	11.3	11.2	carbonate ledge vfg flingsy light y grey	TOP 11.3

ended at 0016 f

7/26/00

Higher tabular units are  
~~expt~~ occur in the  
hills to the west of  
this site in Secs. 11 & 12  
but are poorly exposed  
~~at~~ F.



## SECTION 0017

Westward Ho.

W. D. ROYER &amp; W. GREEN

Starts at loc 0017 in NE, SE

Sec 17 T 85, R 22E

Carbon CO, MT.

Belfry 7'12

wp. 042

N 45° 08.114'

W 109° 02.866'

SECTION STARTS AT TOP OF  
ALLUVIAL fill AT THE BASE  
of a ss ledge

Unit	Int	Thick	Descr
0	0		Top of Alluvium
1	2.1	2.1	Belfry Member - Fort Union Fm Marl, chippy, lt. yell grey
2	2.4	0.3	ledge of ferrug. micrite wh Brown but fr color lt yell grey



0017

7/27/00

- |    |      |     |  |
|----|------|-----|--|
| 3  | 5.4  | 3.0 | Marl, SILTY, yell<br>TAN blocky<br>Becomes fissile<br>Marl above <u>4.5</u>  |
| 4  | 5.8  | 0.4 | Carb sh. Med<br>brownish grey  |
| 5  | 6.2  | 0.4 | LignITE  |
| 6  | 7.1  | 0.9 | Ferrug. SITST  |
| 7  | 8.0  | 0.9 | SS ledge, f.g. SA, dirty<br>IT yell grey &<br>irreg. FLAT bedded<br>at top, becoming<br>shallowly x-bedded<br>in upper 40 cm.<br>also ferrug. brown<br>wh. color |
| 8  | 9.3  | 1.3 | SITST, yellow grey<br>w some chippy<br>mudst inter beds  |
| 9  | 9.9  | 0.6 | Carb sh, with<br>10 cm lign at top<br>gypsum xls   |
| 10 | 11.9 | 2.0 | SITST to SILTY   |

- |     |       |      |   |
|-----|-------|------|---|
| 10c | 12.3  | 0.4  | mudst, chippy<br>SS, vfg, ferruginous<br>in a weak discontin-<br>uous ledge of concret.<br>masses.              |
| 11  | 13.5  | 1.2  | fr silty ss, friable<br>vfg, SA, very dirty<br>wh. yellow grey  |
| 12  | 16.6  | 3.1  | carb mudst, chippy.<br>med. to dark br.<br>grey. Some jarosite<br>on joints ends w/<br>a 0.8m lignite at<br>top |
| 13  | 18.3  | 1.7  | siltst, friable, lt yell<br>grey  |
| 14  | 19.9  | 0.6  | carb sh, w 30 cm<br>lignite at top.   |
| 15  | 19.75 | 0.85 | marl, fissile, st yellowish<br>grey   |
| 16  | 22.2  | 2.45 | SS, vfg, SA, dirty<br>yell tan. // & ripple   |

Sect 0077

- |    |      |     |  |
|----|------|-----|--|
|    |      |     | Upper bd surfaces<br>w interference<br>ripples & rip-up<br>CLASTS of MAR.<br>SS THINS TO N. Always |
| 17 | 26.5 | 4.3 | marl, silty<br>25- fissile yell<br>grey marl.  |
| 18 | 27.0 | 0.5 | SS lens THINS TO<br>0 30 yds N.<br>Vfg, SA, dirty<br>brownish TAN.<br>irreg flat bedded.           |
| 19 | 27.8 | 0.8 | Marl, very lt yell<br>grey, silty  |
| 20 | 31.5 | 3.7 | interbeds of carb<br>shs, thin lignites<br>10 cm (2) +<br>chippy mudst                             |
| 21 | 32.9 | 1.4 | vfg, SA, dirty SS<br>ledge<br>flat & laminar<br>bedded at bs.<br>bcc. flat & shallow               |

7/27/00

Trough x-bedded  
to v. and top  
IT. yell br.

Some ripples &  
ripples w. amplitude  
of 12-15 cm!

22 34.8 1.9 Marl fissile, IT yell  
grey.

23 35.2 0.4 SS, Thin ledge, v. sh,  
SA, dirty, yell br.  
Ferrug. with limonite  
cemented spheres to  
3 cm, Tabular  
ripple laminae.

Thin & thickens  
irregularly along  
strike

24 37.0 1.8 Marl as at #22  
upper 30 cm limonite  
st.

25 37.5 0.5 Carb sh, to carb sh  
to 25 cm lignite  
Brown at top

26 38.9 1.4 mudst, chippy, yell  
grey, w. limonite st.



SECT 0017 WESTWARD 110!

JOINTS

- |    |      |     |  |
|----|------|-----|--|
| 27 | 45.0 | 6.1 | Marl SILTY AT bs<br>fining upw. to<br>chippy Marl<br>40.9 10cm ledge<br>of <u>MICRITE</u><br>6THW as below.                  |
|    |      |     | lower<br>council ss 42.5-43 ledge of<br>0.6 ferrug CALC.<br>vfg ss, w thin<br>ll beds, ripple-<br>marked on upper<br>surface |
| 28 | 45.5 | 0.5 | 44.0 becoming SILTY<br>Upper council ss<br>vfg, SILTY, DIRTY SS<br>yellow brown<br>Trough & chaotic<br>bedding.              |
| 29 | 46.3 | 0.8 | <del>Fractile</del> MUOIST,<br>VERY lt grey to<br>med grey, chippy   |
| 30 | 47.2 | 0.9 | SS, vfg, sm, very<br>friable, does not<br>form a ledge   |



31	52.	4.8	TAN, fissile sh. dec. CARBONACEOUS AT 48. CYCLE REPEATS AT 49 50.5 Carb
32	54.5	2.5	SS friable to concretionary vfg, SA, dirty, yell br., irreg thin bedding. Fines upw. to:
33	56.4	1.9	SILT TO INTERBEDDED MUDST / lignite seg. 54.5-55 paper sh med grey 55-56.4 Carb sh
34	58.5	2.1	Seg coarsens upw from yell brown mudst to a SILT w / concretion lenses of vfg trough th $\lambda$ -bedded SS at 57.5 to 58.5.
35	69.0	10.5	Interbedded SILT MUDST, sh, seg.

SECT 0077

			66.4 Carb Sh
			67. MUDST, Sh
36	69.8	0.9	Marl & micrite
37	71.5	1.7	SS, vfg, sh, dirty, Tabular ledge former ripple bedded throughout

PX 2 Roll 5  
Council SS on  
next spur to  
e of SECT.

Section offset  
to S.

38	76.0	4.5	Sh, fissile grey grading up to siltst chippy at 72.6 75- START of limonite st. mudst 75.4 Carb Sh.
39	76.4	0.4	Lyr. etc

7/27/00

40	77.4	1.0	mudst	med grey.
41	78.5	1.1	S1T5T	
42	82.0	3.5	SS vfg, SA, dirty ledge // bedded x 1.5m.	
			77.6	Softer slope to ss.
			80.5	ledgy ss as below.
				becoming ripple bedded toward top, some contorted and ripple bedding northward.
				where it thickens to a trough a bedded ↓ above the HOT channel
				thickens s. as well. The JABA seq.
43	83.2	1.2	mudst. & shale grey & carb.	

0017

- |     |      |     |  |
|-----|------|-----|--|
| 44. | 85.8 | 2.3 | SITST, IT yell<br>grey becomes<br>fissile in LAST<br>1 m.<br>Grades upward<br>into a           |
| 45  | 90.5 | 5.0 | Vfg, friable ss<br>with wiam<br>bedges toward<br>top THAT ARE<br>TIGHT X-bedded<br>(shallowly) |
| 46  | 92.8 | 2.3 | SITST, IT yell grey.<br><del>to</del>  |
| 47  | 94.0 | 1.2 | Mudst., chippy<br>yell brown.<br>Some carb horizontal  |
| 48  | 97.4 | 3.4 | marl, PLATEY TAN<br>w MICRITE CONCS.<br>between 96.2 +<br>95.7                                 |
| 49  | 99.3 | 1.9 | Interbeds of grey sh,<br>carb sh + THIN<br>lignites  |



7/27/00

- |    |       |     |  |
|----|-------|-----|--|
| 50 | 101.4 | 2.1 | SS, friable at base<br>silty, vfg, dirty<br>ledge above 99.5<br>converted bedding<br>to 100.6 m.<br>11 bedded above<br>100.6<br><del>101.04 Friable SS</del><br><del>interbedded. some</del> |
| 51 | 102.0 | 0.6 | marl, med yell.  |
| 52 | 102.2 | 0.2 | SS ledge, vfg, st<br>micro trough x-bed  |
| 53 | 103   | 0.8 | Brown, disturbed mudst<br>carb sh, & rooted<br>soil  |
| 54 | 103.5 | 0.5 | lignite.   |
| 55 | 104.7 | 1.2 | <del>Interbedded</del><br>yell br mudst  |
| 56 | 105.0 | 0.3 | SS, vfg, yell br.<br>friable   |
| 57 | 106.0 | 1.0 | marl, silty<br>limonite st at<br>top 0.6 m,  |



0017

- |    |       |     |   |
|----|-------|-----|---|
| 58 | 107.6 | 1.6 | INTERBEDS of<br>limonitic mudst<br>(Chipp) carb sh,<br>1 thin lignites  |
| 59 | 109.2 | 1.6 | SS, friable,<br>w thin ll beds<br>on which are<br>plant frags<br>limonite layer<br>6 in x thin<br>carb zone<br>at top |
| 60 | 109.7 | 0.5 | well ind silty<br>micrite w<br>vert roots<br>lt yell br w/<br>limonite st<br>joints                                   |
| 61 | 110.2 | 0.5 | SS, vfg, well ind.<br>ledg, major<br>tabular bed<br>irreg ll bedding  |
| 62 | 110.9 | 0.6 | SS, lt grey<br>fg, SA, dirty<br>calc friable  |

7/27/00

63	111.4	1.5	MICRITE TERRACE well ind. yell br.
64	111.8	0.4	SS, ledgy thin
65	112	0.2	marl, silty, FLAT bedded
66	112.3	0.3	SS ledgy, FLAT bedded semi- friable
67	113	0.7	Marl, silty yt yell br, blocky friable sect 10m partially covered
68	115.2	2.2	Mudst, carb sh, + 25 cm lign at top

Reshoot from top of #66

66b	112.3	-	SS
67b	114.2	1.9	Marl as in prev. sect. Better exp.

SECT 0017

68	115.2	1.0	MUDST, fissile, IT grey. grading upw to carb sh at 114.9
69	115.6	0.4	<del>lyonite</del>
70	115.9	0.3	carb. sh, + grey fissile sh.
71	117.8	1.9	SILTST W 25cm lyonite at top
72	121.5	3.7	SILTST TO THIN carb shs to high as below SECTION PUNKY & badly weathered 119.6 carb sh 120.4 mudst iron brown
73	121.8	0.3	121.5 Union shells to 121.8 Shell hash w/ snails as well
74	123.2	1.4	carb sh.

7/27/00

75	127.3	1.1	Siltst, brown deep wh.
76	124.5	0.2	SS, friable, brown bally wh, w/ carb frags.
77	125.2	0.7	Carb sh, to br. mudst. 500
78	128.5	3.3	mal, very punky & deeply wh.
79	129.1	0.6	Micrite, yell br wh, forms pavement on top of hill ferrous

No more tabular  
beds in hills of  
upper fluvial mbr  
to south.



0018

7/29/00

Margin of Paleocat benches

w/ Walton Green,  
wh. Clear & Hat.

lowest lignite in F. U.  
Fm.

Series of px in road  
cut

3-6 Boundary coal

7- Boundary coal on  
N side of road.

8-13 Lance Fm in  
Little Dry Creek Field

NOTE Lenticular ss

channels in Lance

giving way to

muddy metasette  
below

sl. 14 Picture of Lance

Badlands framed by  
soal cut



7/25/00

- #15 Leached ST ST capped  
by limonite con SS  
Grimy Gulch
- 16 " FLUVIAL CHANNEL  
CUT DOWN INTO THE  
HUNT CREEK Mbr
- 17 Channel cut cut out  
by MANTUA Gulch (Grimy  
Gulch)  
Lebo Mbr laterally  
to channel
- 20-21- Grimy Gulch plant  
loc
- 0019- Grimy Gulch
- 22- Leached S1+ST horizon  
from beneath the  
fossil pl loc.  
(0.5 m) THAT  
CONTAINS rhizomorphs.
- 23- LAST SHOT of Grimy  
Gulch, from W. side

0020

7129/00

~~NW~~ SW, NW, Sec 21, T<sup>58</sup>~~13~~W  
R. 100 W.

POSITION of a Phil Gingerich  
LOCALITY marked as  
CONTAINING T. 4 Vert 1

~~is~~ <sup>near</sup> At base of Belfry  
mbr. or transitional beds.

Levelled to base of Chance  
mbr (Council ss) from here.

Dip 40 to west.

WP 43

N 44° 59.689

W 108° 56.821

elev. 4389

0021

SW, NW, Sec. 20, T 55N, R 100W

ON Council SS at  
Time Warp Gulch

Base of Council here is  
elev. 77.5 m above

The Gingrich Mammal  
T<sub>H</sub> loc. That I placed  
at loc. 0020

w.p. 44

N. 44° 55.502'

W 108° 57.246'

Elev 4518'

55  
11

70  
25  
2 1/2

77 1/2

7/29/00

0022 Center, 5R<sup>1/2</sup> Sec 33  
T9S R 22E, Carbon Co, MT

WP 046

N 45° 0.284'

W 109° 01.901'

elev 4484'

points above beautiful  
section of ~~Red~~ Chance  
mbr. Excellent potential  
section

All C cycles.

Baseball fill in 6<sup>th</sup> cycle



0023

7/29/60

Shooting from top of  
Rosetta ss of Sec  
0017 to top of friable  
of chance m/m

0023 - Westward Ho! (Extended)

0	m.	Top of Rosetta ss
1.8		Marl
3		ss
9		covered
10.5		Friable ss
12		Sandy
14.6		Sandy & wash
15.3		Well indurated ss
26.9		covered

27.6

Friable, lumpy SS

29.6

Covered

30.3

Micrite; erogenous concreted masses in coherent horiz.

31.8

Micrite

TOP OF  $\xi$ ; no stratigraphically higher beds in vicinity.

SECT 0024.

7/30/00

Chance Section

w/WALTON GREEN

SECTION TO be proposed as  
TYPE SECT of Chance mbr

~~Loc.~~ Center NW 1/4, SW 1/4  
Sec. 33, T 9S, R 22E  
Carbon Co., MT.

wp.

N 450 00.407'

W 1050 02.091'

CLV 4211 FT.

IN BOTTOM of Sand Coulee  
on a ledge of:

UNIT	FT	TH.	DESCR
0	0	0	Belfox mbr, F. U. fm Brown grey, & fg. Ledge ss. forms bottom of channel
1	3.0	3.0	IN MOSTLY MALL w/ THIN ll bedded

- |   |      |      |  |
|---|------|------|--|
|   |      |      | SS ledge<br>20 cm thick<br>at 0.5                                |
|   |      |      | 4 lenses of brown<br>& yell wh micr.<br>at 1.4-1.6               |
| 2 | 3.6  | 0.6  | Brown grey carb<br>sh w 5cm lign<br>at top                       |
| 3 | 4.0  | 0.4  | marl, yell grey<br>bedded.                                       |
| 4 | 4.4  | 0.4  | SS ledge, fiat<br>bedded, vfg;<br>poorly ripple<br>bedded on top |
| 5 | 6.8  | 2.4  | 6.1 SS ledge to<br>20 cm   |
| 6 | 7.3  | 0.5  | SS, vfg, SA, drity<br>Br. grey wh.<br>Forms ledge<br>   bedded.  |
| 7 | 21.6 | 14.3 | Covered interval<br>Forms a prominent<br>covered shoulder        |

IN THE SECTION

12.1-12.6 SS ledge  
Protrudes from  
COVER mantle

15.8-16 SS ledge  
do. above

Slope above is  
TAN & sandy.

17.1-17.4 WCAIN,  
friable SS ledge

8 22.5 0.9 SS, ledge, vfg, SA,  
dirty, yellow grey  
shallowly troughed t-b  
at base becoming  
irreg bedded  
upw.

9. 27.2 4.7 Covered

10 28.4 1.2 ~~SCarb sh~~

11 29. 0.6 SS, vfg, SA, dirty  
Brownish grey with  
small scale trough  
x-beds.



0024

- |     |      |     |  |
|-----|------|-----|--|
| 12  | 32.0 | 3.0 | <p>Seq STARTS w<br/>fissile, med yll<br/>grey siltst<br/>grading upw to<br/>a <del>fine</del> friable<br/>weakened resist.<br/>SS at 30.72<br/>Then FINEB<br/>upw above<br/>top of SS at<br/>30.6 to<br/>siltst fissile<br/>grey at top.</p> |
| 13. | 32.9 | 0.9 | Brown carb sh  |
| 14  | 34.3 | 0.5 | MARL.  |
| 15  | 36.5 | 2.2 | <p>Basal bed of<br/>corncl ss.<br/>①<br/>Chance mbr of F.V.<br/>ss, vfg, s.a., t.<br/>Trough x bedded<br/>undulated at top<br/>x x bedded<br/>Contorted bedding</p>  |
- ① - cycle #

7130/00

- in middle  
bec. 11.8 ripple  
bedded in upper  
O. F. N.
- 16 38.0 1.5  
② PLATEY, Thin (2- $\frac{1}{2}$  cm)  
interbeds of SS  
in a MARL MATRIX  
yellow tan  
SS beds decime  
thicker upw  
Upper Contact  
vfg, SA, dirty  
ledge, shallowly trough  
X-lam. & bedded.  
Throughout  
Forms prominent  
marker (w 15+ft)  
Throughout sand  
covered on which  
basal cont. of  
Chance Mbr. was  
based
- 17 38.7 0.7  
②
- 18 39.7 1.0  
② SS, friable, yellow  
grey, SA, vfg. d.  
forms shoulder

0024

- |     |      |     |     |  |
|-----|------|-----|-----|--|
| 19  | 41.9 | 2.2 | (E) | Fissile, med yell<br>grey, <u>SITST</u><br>with carb sh<br>interbeds.  |
| 20  | 43.5 | 1.4 | (E) | carb sh predom<br>inates but<br>interval badly<br>wh & covered.<br>partially<br>starts w a 0.4m<br>yell grey friable<br>SITST  |
| 21  | 46.1 | 2.6 | (L) | marl, sandy, IT.<br>yell. grey w<br>limonite stained<br>joints & <del>foot</del><br>& root casts<br>becomes a fissile<br>marl at<br>44.4<br>finely bedded,<br>carb sh. <del>finely</del><br>w thin lign<br>beds. |
| 22. | 47.2 | 1.1 | (F) |  |

23 47.9 0.5 Lignite  
①

24a 50.5 2.6 Marl, fissile, fine  
Thinly bedded.  
IT yell grey  
②

24b 55.5 5.0 (M-2) A major  
TABULAR SS  
forming a prominent  
ledge throughout  
SAND COVER  
②  
④

vfg, sa, DIRTY, IT  
brownish grey to  
TAN, w TABULAR  
ripple x lam (beds)  
AT base, trough  
x-beds at in  
middle & top

53.2 w MARL inter  
beds (2) up to  
~~0.6 m thick~~

53.2 MICRITE, 5' grad,  
SILTY, THIN  
bedded w INTER-  
ference ripples

53.8 MARL



0024

54.2 SS ledge  
ripple bedded

54.6 marl

54.8 SS ledge  
Thin irregular  
bedsForms top of  
prominent  
Shoulder25 56.7 1.2 Interbeds of sand  
silty marl  
(1/2 yellow grey)  
0.5 m x SS  
0.5 m is below.  
SS ripple &  
contorted.

26 57.4 0.7 marl

27 58 0.6 Carb sh & Thin  
lignite28 63.1 5.1 Brownish grey  
bedded marl  
Interval partially  
covered.



7/30/00

- |    |      |     |   |
|----|------|-----|---|
|    |      |     | Some SITST interbeds  |
| 29 | 66.1 | 3.0 | Med. yellow grey<br>SITST, thin bedded  |
| 30 | 68.9 | 2.8 | Marl, thin bedded<br>med. IT, yell grey   |
| 31 | 69.5 | 0.6 | SS, fg, SA, dirty<br>ripple bedded in<br>1" ripple sets<br>The third major<br>shoulder forming<br>tabular SS in<br>region |
| 32 | 71.0 | 1.5 | Interbedded marl<br>ripple bedded<br>limonite st. vfg SS<br>beds. on order of<br>0.2-0.4 m                                |
| 33 | 72.1 | 1.1 | Carb sh & thin<br>limonite bed<br>Some limonite st.<br>beds. Sh med<br>grey   |
| 34 | 73.1 | 1.0 | SITST, bedded, it yell<br>grey coarsens upw<br>to a vfg, SA, dirty SS<br>at 72.9  |

0024

- |    |      |     |   |
|----|------|-----|---|
| 35 | 74.8 | 1.7 | S1757 bedded.<br>IT yell grey &<br>w limonite st.<br>(L)  |
| 36 | 79.6 | 4.8 | Marl as below<br>w a horizon of<br>micrite nodules<br>(L)<br>IN INTERVAL<br>75.9 - 76.2<br><del>77.85 - 78.05</del><br>77.85 - 78.05<br>Thin ledge of<br>micritic, vfg ss<br>micrite - in pods<br>up to 8" thick. |
| 37 | 79.8 | 0.2 | (L)   |
| 38 | 80.5 | 0.7 | Marl thin bedded<br>IT yell. grey<br>(L)  |
| 39 | 81.1 | 0.6 | SS, Thin ledge<br>ripple bedded<br>lith as below<br>This is together<br>(H) w/ the next<br>highest is the<br>4th major  |

7/30/00

Tabular ledge  
formed in depth  
Hollowyah I?

40 84.8 3.7

(2)

SLITY MARL w/  
some few thin  
micritic, ripple  
bedded SS interbedded

41 86 1.2

SS ledge, vfg etc  
INTC ferrous ripples

42 87.9 1.9

MARL, IT yell green

43 88.1 0.2

SS, vfg, SA, ledge.  
X IT hr. grey  
ripple marked

SLH MAJOR SS

formed

Forms large dip  
slope in the grit

Dip set to  $1/2^\circ$  e

SECT. shifted to  
only c to  
catch upper  
part of sect

0624

- |    |                 |      |   |
|----|-----------------|------|---|
| 44 | 88.6            | 0.5  | vfg ss & marl<br>interbedded. 1-1 1/2<br>inches ripples<br>occ.   |
| 45 | 88.7            | 0.1  | carb sh & thin<br>lignites  |
| 46 | <del>89.5</del> | 0.8  | Fissile marl<br>it yell grey  |
| 47 | 89.8            | 10.3 | ⑥ Highest ledge<br>of tabular<br>seq.<br>Trough x bedded<br>micritic, vfg, sh<br>color rusty<br>ferruginous<br>wh. occ. thickens<br>to off m<br>Shallow trough<br>& some faint<br>chaotic disor. y.<br>bedding. |
| 48 | 91.5            | 1.7  | Interbed silty marl<br>(thinly bedded)  |



7130100

W/ Thin ss interbedd  
to 1"

2 of them  
Upper Fluvial

\* 49 93.9 2.14 Carb sh sep  
~~very~~ dark grey  
92.4 - 92.8 lignite  
w jarosite

50 94.0 0.6 Friable ss, vfg  
lens becomes a  
SILTST laterally  
lens makes only a  
weak shoulder

51 95.2 0.6 Carb sh, mudst,  
lign

52 95.8 1.2 Fissile mud  
packed w UNID  
shell frags

53 97 3.1 mudst, carbonaceous  
ending in 0.3 m of  
Carb sh.

54 100.1 0.9 Fissile mudst  
olive brown

70 p

w/ white gyp  
"DUST BALLS"

97.9 ~~Start~~

MASSIVE mudst.

TO S11757.

TO Thin ferrug  
SS lens AT

98.6 to 98.7

55, 101.0 1.1

Ferrug MILCRITE

4 CONCS layer

IN S1757 CONCS

3 - 8" thick.

S1757 med

gtl greenish

grey

MILCRITE CONCS

100.3 + 100.6

56 102.1 2.9

SS, friable

vfg, sr. dis. -

fr. thickens

to form to lens

of ind ss

N ward

57 105 1.8

MUDST, fissile

brown

0024

58 106.8 0.7

LeNT ss, fg, sq,  
dirty

Festooned x-bedded  
Downcutting at  
base

58b 109.5 2.7

Brown mudst

59 109.8 0.8

Ferrug. micrite  
concs.  
Form

SECTION shifted to  
top of Hill  
Lateral dist ~  
200' to east.

IN THAT DIST.  
A unit 59

is cut out

by a ss channel  
Edges of micrite  
look like algal

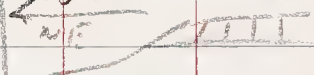
heads or bog Fe ore.

60 110.6 1.0

Friable, fg ss  
becomes a fest. x-b  
channel internally

0024

- 61 111.6 0.4 mudst, siltst  
interbedded.  
Thin ss at  
110.8 (10 cm)  
becomes a  
0.7 m channel  
50' to NE
- 62 112.0 0.6 carb sh.

- 63 112.6 3.1 SS friable  
yell brown  
cuts out a  
micrite cone  
layer to SW.  
from line of  
Sec 1 → SW  
← NE
- 

at 114.4 ss  
bec. indurated  
Large scale  
through x-  
beds  
A lens  
Tabular x beds



7/30/00

115.7

Top of Section

Above this is only  
FLUVA) FU.

0025 BASEGAIL Hill' dol

W P 48

N 45° 00, 365

W 109° 02, 558

elev. 4290

---

dol (Base of P.T.)

lies ~~below~~ 1.3 m

above the top of

UNIT 41 (SS) of

SECT 0024

occurs in a med gray  
marly sh ~~in~~ below a  
d. 55 marl & micell?

002c

8/1/00

RENTALS  
#5 collected  
↓ 6/13/  
2007

old loc 9918

WP ASPEN

W/W. Green

N 42° 05.988'

W 110° 30.124'

elev 7100'

CN Sec 6 T 24N R 115W

Aspen Sh Loc of  
LAST Summer on  
Bluff at JCT of  
Boney Cr & Fontinelle  
Cr.

STARTED EXCAVATION AT  
level d. "mixed angios"

0026 d. Census

N 0%

Sap. belvidereensis III AS-32 5 4

CRASSIDENTICULUM III (AS-32) 5 4

(AS-31)

Sap variabilis III III III III III  
III III III III III III III III  
AS 9/55  
65

0026

8/1/00

MARTINIACEAE ?

25

TINY PINNULES IIII IIII IIII IIII IIII

Equisetum ? 1

2

Magnolia leaf 1

1

PLATANOID INF. 1

1

Nelumbites 1

1

Brachyphyllum 1

1

Indet palmate w large chlor  
teeth 1

1

Indet Trapezoid leaf 1

1

Indet bract ? 1

1

"Sassafras" type 11

3

Trochodendracean palmate 11

4

Indet fruit ? 1

1

117



Ecno  
2/17/77 #

86

21

AS-4

AT 0026g The fossils occur in the upper 10 cm of a porcellanous ash. AS-5

0.7

0.8

AS-20

Ash is ~ 60-80 cm

thick ~~cap~~

0.7

0.8

and in lower portion are found rhizomes & mats of plant matter but no US

0.8

AS-8

~~SS~~ UNIT is capped by a 30 cm vfy, tuftaceous ash showing shallow X beds. (Trough)

0.8

0.8

AS-11

0.8

2.5

AS-16  
(56045)

3

0.8

8/1/00

0026 c

CENSUS

Trachodesmoid IIII 1

Glyptostrobilus IIII III III III

Fat coarse serrate IIII IIII IIII IIII  
IIII

TRIGANTIC 1

Palmato PLATAEoid III IIII

PIAT. INF. IIIII IIII II

Ruffordia IIII IIII III IIII IIII IIII II

Sap. variab. IIII IIII IIII IIII IIII

Sap. belv. IIII IIII IIII IIII IIII IIII IIII  
IIII IIII IIII 1

"Liquidambar" II

Cladophlebis 1

CRASSIDENTICOLUM II

Teconotype  
↓  
Dens. added  
6/13/2007

6	3	AS-13
18	10	
25	14	AS-18
1	0.5	AS-25
9	5	<del>AS-10</del> , AS-16 (55845)
12	7	
28	16	AS-2
25	14	
51	28	AS-22
2	1	
1	0.5	
2	1	AS-31

180

0027

8/2/00

W / WALTON GREEN  
HAZY & WARM

W.D. FONTINELLE

N 42° 05.675'

W 110° 29.866'

elev 7529'

Top of a ledge of  
Tuffaceous Aspen  
sh. that appears to  
be the on-strike  
continuation of

The fossil containing  
tuffs at 0026.

Found a few scraps  
but no recognizable  
plants.





SECTION 0026

STARTS IN THE ASPEN  
 SH. AT CREEK LEVEL  
 15 M W OF THE EAST  
 END OF THE SURF  
 ON FORTWELL CR.

0	DP	Aspen Sh
1	4	med grey fissile <del>med</del> silty sh w 2-4 cm thick beds of tuffaceous siltst. That are rusty some of these are fig. sr. Tuffaceous ss. Rusty grey brown most of unit is med grey siltst. (H. 4)
2	5.0	Porcellanous opharitic med grey volc ash w tuffaceous or small beds unit forms a unit shoulder (8)

3

5.9

Interbeds (11) of  
yell grey, f. s., SA  
Tuff SS.

from ~~5.7~~ 2.80

thick in med  
grey porcellanous  
with clayst (217,  
volc ash?)

Resistance = 7

4. 10.5

~~Sh as~~ Silty sh as in  
unit #1

w/ bed of tannish  
grey, resistant  
(tuffaceous) porcellanous  
at 9 m that

thickens from 10 cm  
to 40 cm to W.

5. 11

SS, vfgs. SA (tuffaceous)  
downcut 1/2 m  
into underlying  
shale laterally  
Trough x-bedded  
at base, becoming

1.9

0.5

0026

plane bedded at  
top  
Thins w warf

6. 11.6

Yell grey, porcellin  
ous siltst,  
blocky, hackly  
w some vertical  
limon to st  
An old vole  
soil?

7 11.8

siltst, porcellin  
massive, blocky  
lt. yell, grey

8 12.4

tuff, blocky  
lt grey  
upper 15 cm, wh.  
punky, limonite  
st, w poorly  
preserved  
rhizomes

9. 13.2

Porcellinose,  
med grey,  
w hor & vert



10. 14.4

rhizomes

cr. resistance (7)

IT yell grey, massive  
blocky in tuffa  
cross slt st.

Shows ~~some~~

ll & low 2 x  
lamination in  
basal 1/3

Has vertical  
rhizomorphs in upper  
1/3

14 - IT grey tuff  
slt st, w vert  
rhizo.

w a 20 cm bed of  
porcellinoid red  
grey tuff from  
14.2 to 14.4

b → Tuff contains  
oozob flora

w vert & hor. rhizomes  
and mats of Fern  
rachises.

(A soil dev. on a

14.4

Sec 7, 0026

11. 14.7

volc ash.  
SITY tuff,  
lt yell grey,  
chippy, w  
comminuted GIANT  
frags and one  
twisted pinna  
of Ruffordia  
at very base

(Tuff CATASTROPHY  
Lahar?)

12. 17.6

Greenish grey  
MASSIVE  
blocky wh SITY  
w carb films  
& irreg bedding  
(looks like an  
incipient soil)  
becomes a med  
greenish grey  
w/ rhizomes x  
poor pl. Scraps  
~~upw~~ + laterally

8/2/00

- |    |      |  |
|----|------|--|
| 13 | 17.8 | SITST<br><del>SITTY</del> , IT yell grey<br><del>SS</del>  |
| 14 | 19.1 | SITST as at #12  |
| 15 | 21.1 | greenish<br><del>tuff</del> grey, blocky<br>aphanitic, CLAY ROCK<br>Appears mottled<br>w/ limonite & to<br>be disrupted<br>but no peds<br>or rhizomorphs.<br>Rare<br>poorly resist (5) |
| 16 | 22.0 | Greenish grey<br>MASSIVE tuff<br><br>poorly resist (7)<br>blocky but massive<br>forms a ledge.   |
| 17 | 22.3 | tuff, aphanitic<br>olive gr to<br>IT grey, silty<br>This is fluorite <u>C</u>  |

SECT 0026

18 23.0

SITST, olive grey  
poorly resistant  
becomes more  
resistant and  
aphanitic at  
22.8

22.9 - It grey  
silty tuffaceous

~~SITST~~

grading down-  
ward to  
aphanitic  
UNIT.

19 23.1

SITST, tuffaceous  
appears to  
represent a  
water laid deposit  
massive

20 24.8

SITST, med olive  
grey becomes  
more resistant  
in last 0.4m  
w florule 0026d  
in upper 15cm



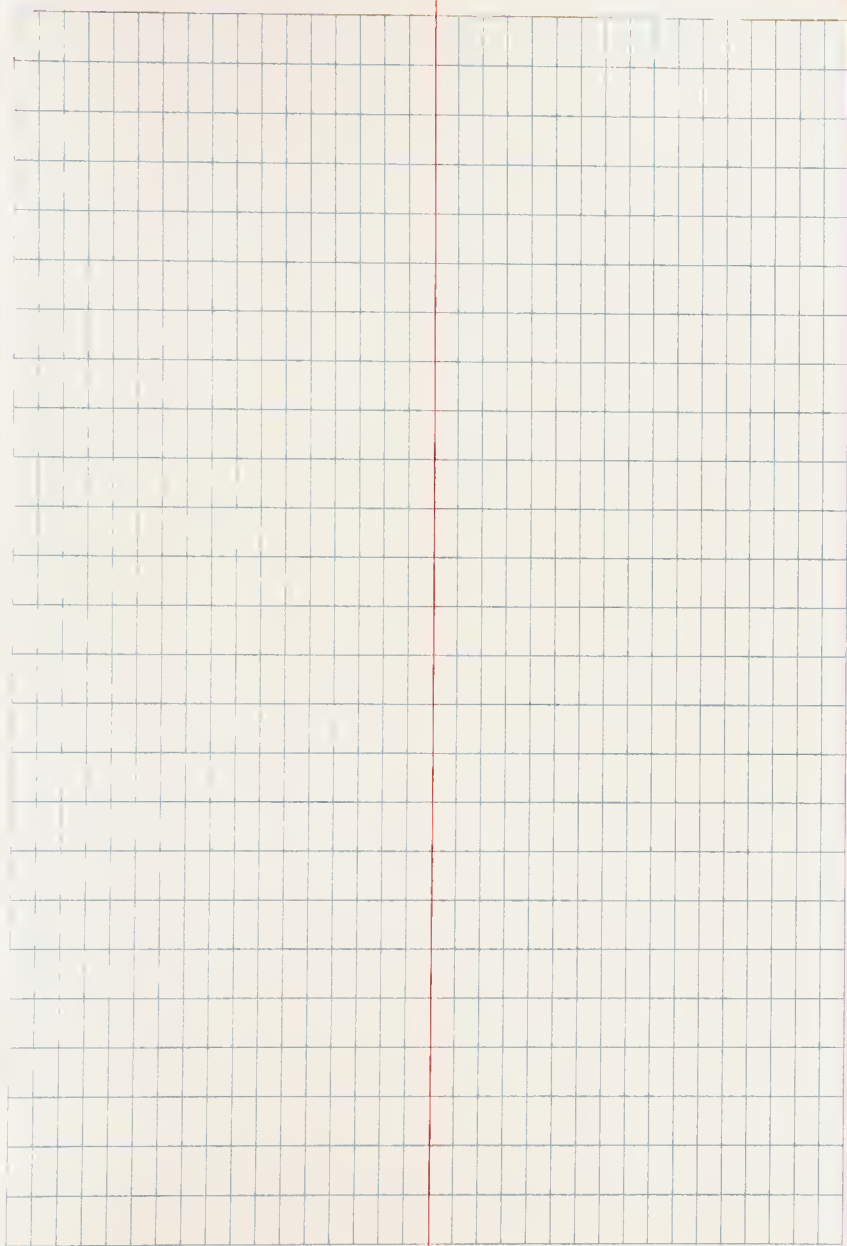
8/2/00

25.3

Vfg, SB, Tuffaceous  
w low angle  
x-lam at base  
which appears  
downcutting.

Top of section













Bill Rember

305 ~~Lauder~~ Lauder

#404

Moscom, ID 83843

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Jeff + Susan Parker

27 ~~Evans~~ <sup>Hawing</sup> Hills

Chilmark, MA 02535

218,8075

278.1

Walter + Beryl Churchill

307-754-4865

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Rain-resistant fine quality ledger paper, bound in high-visibility durable yellow imitation leather. Printed in waterproof ink.

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Right page 4 horizontal and 8 vertical blue lines; red vertical center line. Pages numbered and perforated. Carbon paper.

SERIES	GROUP	SUB-GROUP	FORMATION	MEMBER	K-Ar AGE (m.y)	MAGNETIC POLARITY		
MIOCENE	UPPER	COLUMBIA	BASALT	SUBGROUP	LOWER MONUMENTAL MEMBER	6	N	
					EROSIONAL UNCONFORMITY			
					ICE HARBOR MEMBER	8.5	N R N	
					EROSIONAL UNCONFORMITY			
					BUFORD MEMBER		R	
					ELÉPHANT MOUNTAIN MEMBER	10.5	R, T	
					EROSIONAL UNCONFORMITY			
					POMONA MEMBER	12	R	
					EROSIONAL UNCONFORMITY			
					ESQUATZEL MEMBER		N	
					EROSIONAL UNCONFORMITY			
					WEISSENFELS RIDGE MEMBER		N N N N	
					Basalt of Slippery Creek Basalt of Tenmile Creek Basalt of Lewiston Orchards Basalt of Cloverland			
					ASOTIN MEMBER	13	N	
	Basalt of Huntzinger							
	LOCAL EROSIONAL UNCONFORMITY							
	WILBUR CREEK MEMBER		N N					
	Basalt of Lapwai Basalt of Wahluke							
	UMATILLA MEMBER		N N					
	Basalt of Sillust Basalt of Umatilla							
	LOCAL EROSIONAL UNCONFORMITY							
	MIDDLE	COLUMBIA	BASALT	BASALT	SADDLE MOUNTAINS	PRIEST RAPIDS MEMBER	14.5	R R
						Basalt of Lolo ← Basalt of Rosalla ←		
						ROZA MEMBER		T, R
						FRENCHMAN SPRINGS MEMBER	15.3	N N N N, E E
						Basalt of Lyons Ferry Basalt of Sentinel Gap Basalt of Sand Hollow Basalt of Silver Falls Basalt of Ginkgo Basalt of Palouse Falls		
						ECKLER MOUNTAIN MEMBER		N N N
						Basalt of Shumaker Creek Basalt of Dodge Basalt of Robinette Mountain		
GRANDE FONDE						15.6-16.5	N <sub>2</sub>	
PICTURE GORGE BASALT							R <sub>2</sub>	
							N <sub>1</sub>	
							R <sub>1</sub>	
IMNAHA BASALT						16.5-17.0	R <sub>1</sub> T N <sub>0</sub> R <sub>0</sub>	
(See Hooper and others, 1984)								

← Small Creek

← MISSISSIPPI  
← JULIETTA

Figure 2. Stratigraphy of the Columbia River Basalt Group. Modified from Swanson and others (1979) by Reidel and Fecht (1987). Natural remanent magnetization indicated by: N=normal, R=reversed, T=transitional, and E=excursional.



# 2000 - Field Trip.

S	M	T	W	T	F	S
	10	11	12	13	14	15
16	17	18	19	20	21	22
23	24	25	26	27	28	29
30	31	X	X	X	X	X
6	7	8	9	10		

- 11 Left NH - Clarion, PA
- 12 Chicago Ill - Car repairs in Toledo
- 13 Mitchell SD
- 14 Powell, WY
- 15 Works w/ Dana in Powell Area.
- 16 To Mallard Is near Scott
- 17
- 18 Works w/ Dana in T.V. for contacts
- 19 Leave for Clarion
- 20
- 21
- 22 ~~Back to PA~~
- 23 Back to PA.
- 24 Works in PA area
- 25 "
- 26 "
- 27 "
- 28
- 29 End of Beefry in
- 30 Final day of Beefry in
- 31 Done to Whimmed
- 1
- 2
- 3 Drive to Red Lodge Back to PA.
- 4 Park up



5 Leave for Home

6

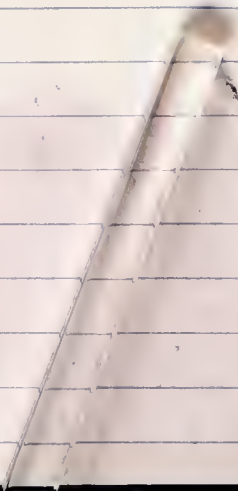
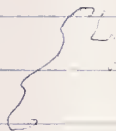
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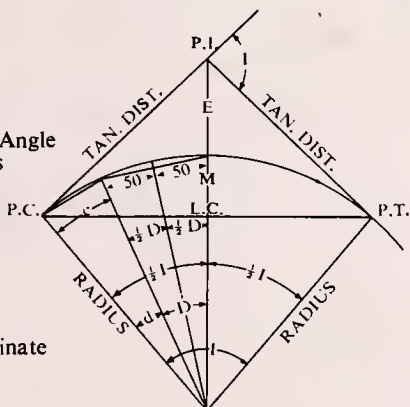
Arrive in NY





## CURVE FORMULAE

- D = Degree of Curve
- 1° = 1-Degree of Curve
- 2° = 2-Degree of Curve
- P.C. = Point of Curve
- P.T. = Point of Tangent
- P.I. = Point of Intersection
- I = Intersection of Angle, Angle between Two Tangents
- L = Length of Curve, from P.C. to P.T.
- T = Tangent Distance
- E = External Distance
- R = Radius
- L.C. = Length of Chord
- M = Length of Middle Ordinate
- c = Length of Sub-Chord
- d = Angle of Sub-Chord



$$R = \frac{L.C.}{2 \sin \frac{1}{2} I} \quad T = R \tan \frac{1}{2} I = \frac{L.C.}{2 \cos \frac{1}{2} I}$$

$$\frac{L.C.}{2} = R \sin \frac{I}{2}, \quad D 1^\circ = R = 5730, \quad D 2^\circ = \frac{5730}{2}, \quad D = \frac{5730}{R}$$

$$M = R (1 - \cos \frac{1}{2} I), \quad = R - R \cos \frac{I}{2}$$

$$\frac{E + R}{R} = \sec \frac{I}{2}, \quad \frac{R - M}{R} = \cos \frac{I}{2}$$

$$c = 2 R \sin \frac{1}{2} d, \quad d = \frac{c}{2R}$$

$$L.C. = 2 R \sin \frac{1}{2} I, \quad E = R (\sec \frac{1}{2} I - 1), \quad = R \sec \frac{I}{2} - R$$

### Minutes in Decimals of a Degree

1'	.0167	11'	.1833	21'	.3500	31'	.5167	41'	.6833	51'	.8500
2	.0333	12	.2000	22	.3667	32	.5333	42	.7000	52	.8667
3	.0500	13	.2167	23	.3833	33	.5500	43	.7167	53	.8833
4	.0667	14	.2333	24	.4000	34	.5667	44	.7333	54	.9000
5	.0833	15	.2500	25	.4167	35	.5833	45	.7500	55	.9167
6	.1000	16	.2667	26	.4333	36	.6000	46	.7667	56	.9333
7	.1167	17	.2833	27	.4500	37	.6167	47	.7833	57	.9500
8	.1333	18	.3000	28	.4667	38	.6333	48	.8000	58	.9667
9	.1500	19	.3167	29	.4833	39	.6500	49	.8167	59	.9833
10	.1667	20	.3333	30	.5000	40	.6667	50	.8333	60	1.0000

### Inches in Decimals of a Foot

$\frac{1}{16}$	$\frac{3}{32}$	$\frac{1}{8}$	$\frac{3}{16}$	$\frac{1}{4}$	$\frac{5}{16}$	$\frac{3}{8}$	$\frac{1}{2}$	$\frac{5}{8}$	$\frac{3}{4}$	$\frac{7}{8}$
.0052	.0078	.0104	.0156	.0208	.0260	.0313	.0417	.0521	.0625	.0729
1	2	3	4	5	6	7	8	9	10	11
.0833	.1667	.2500	.3333	.4167	.5000	.5833	.6667	.7500	.8333	.9167

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