

HARZA-EBASCO

Susitna Joint Venture
Document Number

54

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DOCUMENT CONTROL

P5700.16.996

XEROX COPIES

AAI FIELD BOOKS, GEOLOGY

002 3/3

DCNO 54

DEVILS CANYON

SURVEYORS NOTES

DIKE SURVEY

H1 = 4.23

DIKE "HUNT"

J KARR T M

9/9/81

RAIN
WIND 13-15 MPH
57°F

P.A. 3

ES H X Z X SD HD

32-332

T © 32-331 BS 32-332

32-331

D) 0-00-00

R) 179-59-55

701

D81-201 79-22-00 95-35-30 1166.89 1161.34

702

D81-202 79-14-30 97-56-50 1131.95 1121.08

703

D81-203 78-01-47 100-39-40 1088.25 1069.46

704

203A 79-04-00 100-48-05 1089.99 1070.68

32-331 177-16-21 1245.81

D 1) 77-16-21 90-18-25

R) 77-19-20 90-46-05

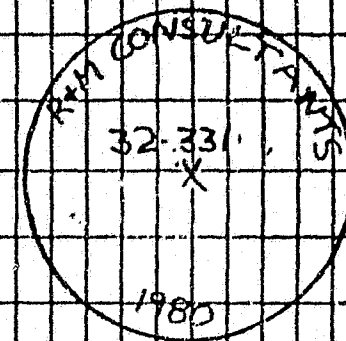
SEE PAGE 24

R) 1) 257-6-10 269-13-12

R) 257-19-15 269-11-08

GURDY

FOUND 5/8" REBAR W/3" AL CAP



4 DIKE 25' WIDE

D/S SIDE

U/S SIDE

D/S SIDE

HI= 4.47		DIKE HUNT II		J KERR T II		9/10/80		52°F LIGHT SHOWERS CALM		A	
		HX	ZY	S DIST		HD					
		.A @ 32-332B BS		32=331							
D)	L	0-00-00	89-17-43	2594.975		2594.77					
	R	0-03-25	89-15-28								
	M	0-01-43	89-16-36								
				SEE PAGE 23 FOR WORK DONE 3800A W/ T2							
R)	L	180-00-10	270-42-50	2594.960		2594.89					
	R	180-03-10	270-40-35	2594.960		2594.96					
	M	180-01-40	270-41-43	2594.890		2594.89					
		* SEE NOTE BELOW									
✓105	1	37-29-20	103-31-50	1004.94		977.05					
✓106	2	39-06-50	103-12-30	1007.97		981.30					
✓107	3	37-32-10	108-06-40	960.13		912.56					
✓108	A	36-03-45	108-47-40	961.32		910.06					
✓109	5	35-49-35	114 140-40-15	913.40		830.03					
✓110	6	33-55-20	116-08-20	891.05		799.92					

* ALL HORIZONTAL 4'S ARE IN REDUCED FORM

SET 5/8" REBAR W/2" ALCAP 2 FT
ABOVE GROUND ON TOP OF CLIFF
JUST EAST OF LARGE REYINE ON SOUTH
SIDE OF DEVILS CANYON APPROX 2000 FT
WEST

R + M

32-332B

X

1981

D/S DIKE

SAME APPROX E

U/S DIKE

U/S SIDE - 2 FT

D/S SIDE

U/S SIDE

9/10/81

	H	Z	X	S	D
711	7	31-25-25	127-54-45	845.25	666.86
712	8	30-56-10	127-18-10	851.74	677.51
713		28-53-40	129-06-25	851.47	660.72
714		29-10-55	130-01-30	843.65	646.04
32-332C1		58-45-30	92-54-01	954.020	952.81
D	R	58-48-45	92-51-45		
M		58-47-07	92-52-53		
L		238-45-40	267-07-25		
R	R	238-48-40	267-05-05		
M					

T2 ON PAGE 22

U/S
D/S
EDGE OF RIVER D/S
EDGE OF RIVER
SET 5/8" REBAR W/2" AL CAP. ON CLIFF TOP NORTH SIDE DEVILS CANYON
R+M 32-332C X 1981

HI = 4.87

HP

H X

Z X

S.D

π

@

32-332C

BS 32-332B

4.27

D

R

M

R

R

N

715

12

32-22-00

126-24-45

836.79

716

108-11

29-28-45

124-40-10

847.26

717

10

28-31-00

120-30-55

861.45

718

9

29-05-25

117-41-00

894.56

719

8

28-20-50

114-15-15

934.59

720

5

24-11-20

108-04-50

984.63

9/10/61

6

U/S

SIDE

ROVER

LEVEL

APPROX

2'

D/S

FROM

U/S

EDGE

7

HD

971.25

1099.31

1091.26

DEPTH 12' UPSTREAM

Dike. 8110

HK

2x

SD

T@ 32-331 B	BS 32-331
-------------	-----------

BS 32-331

724	1	345-27-40	99-35-30	1140.26
-----	---	-----------	----------	---------

725	2	344-29-25	95-15-10	1180:47
-----	---	-----------	----------	---------

726	3	345-41-40	95-00-00		1177.61
-----	---	-----------	----------	--	---------

727	4	396-32-05	96-31-10		1147.51
-----	---	-----------	----------	--	---------

728	5	346-12-15	101-19-55	1129.75
-----	---	-----------	-----------	---------

729	6	345-55-00	103-17-00	1116.87
-----	---	-----------	-----------	---------

7	10	12	15
---	----	----	----

9/11/81

3

2-1-1

32-331 B

*

1930

HI = 4.63

DIKE

81-78

H. X

Z. X

SD

T @ 32-332 D BS 32-332

730 1 41-23-25 124-47-50 777.27

731 2 42-28-55 121-32-20 801.62

732 3 41-31-20 121-35-10 801.36

733 4 41-51-10 118-21-10 817.97

734 5 42-20-50 118-12-35 817.84

735 6 42-34-45 111-33-25 831.00

736 7 43-45-15 107-09-30 867.05

737 8 44-03-00 102-38-10 907.16

738 9 44-18-25 97-00-30 969.49

739 10 44-57-55 93-07-00 1023.01

SET 5/8" REBAR W/ 1/2" ALGAP

AT GROUND LEVEL

RIVER LEVEL

32-332 D

1981

HI = 4.10

H1=4.63

DIKE

81-79

Hx

Zx

SD

π @

32-332 D

BS 32-332

740

1

69-05-35

128-56-30

689.00

741

2

69-14-45

125-12-10

696.45

742

3

26

69-26-50

120-32-40

708.31

743

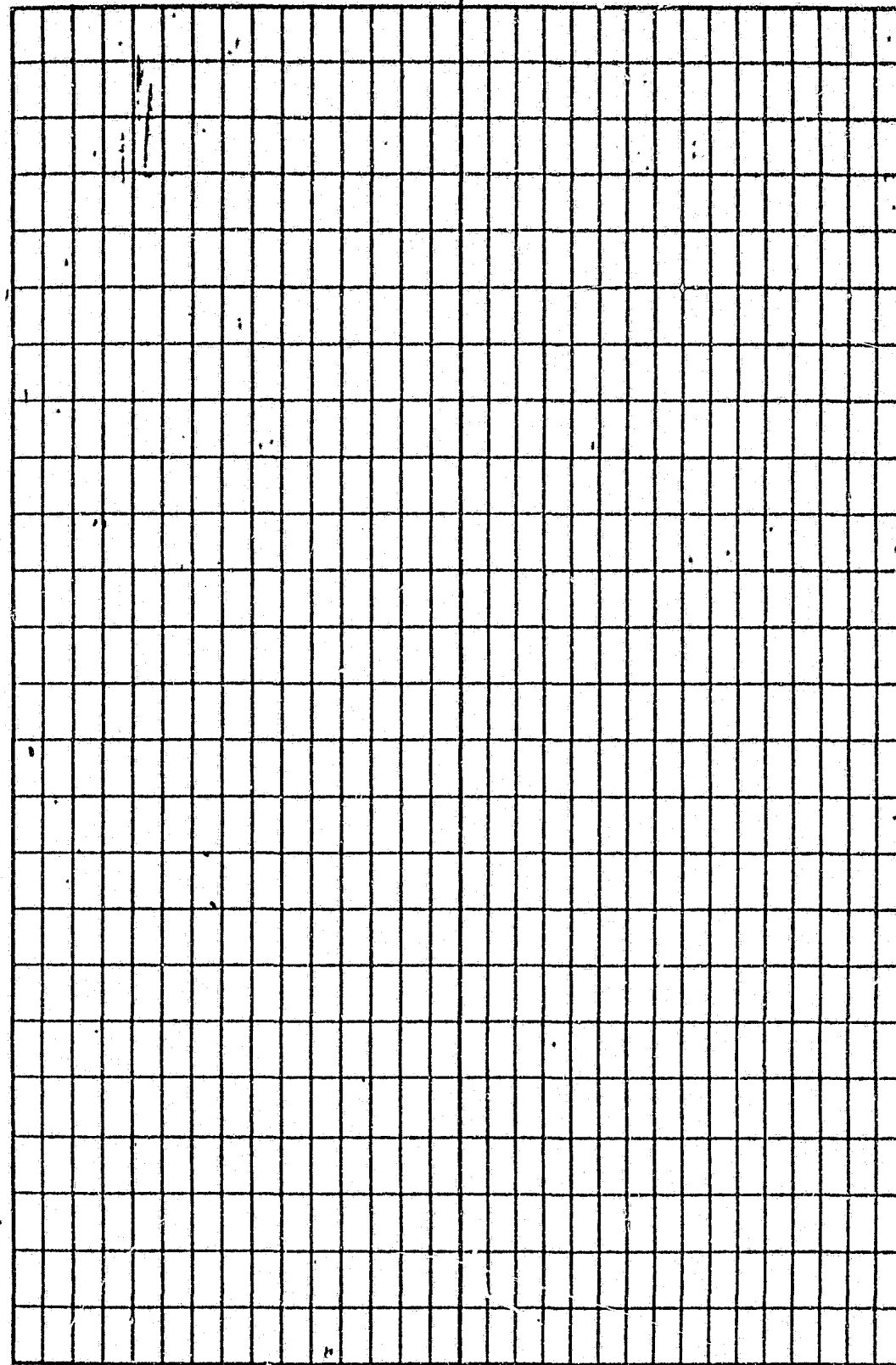
4

69-45-25

116-03-10

729.80

10



H1 = 4.59

DIKE 81-122

H₂

21

SD

A° @

32-3320

BS 32-3320

744

1

55°41'10" 98°29'30"

881.28

745

2

54-33-12 112-21-04

794.59

746

3

53-26-20 116-57-58

767.27

747

4

54-35-25 123-38-14

743.18

748

5

54-24-58 127-17-10

730.86

T KERR A°
E CHRISTIANSON LI

9/12/81

CLEAR
WIND 0-2 MPH
48°~~3 FT~~ 2 FT ABOVE RIVER

H1=4.95

Dike

81-91

H 4

Z 4

SD

π @ 32-332 E 85 32-332

749 1) 327-02-49 82-26-10 848.87

750 2) 327-23-45 85-26-13 813.38

751 3) 330-03-31 86-17-05 785.44

752 4) 330-11-39 88-50-11 767.24

753 5) 330-48-01 91-24-35 753.83

754 6) 330-20-25 95-22-31 725.15

755 7) 329-54-57 95-24-15 723.99

756 8) 331-10-56 98-17-20 699.10

757 9) 332-07-29 99-07-30 695.09

E. CHRISTIANSON π

J. KERR III

9/12/81

12

SET 5/8" REBAR W/2" CAP
 ON 50' WIDE BY 150' DEEP AREA
 ON NORTH EAST SIDE DEVILS
 CANYON APPROX 315 FT ABOVE
 RIVER ALCAP IS .5 FT ABOVE
 GROUND

R+M

32-332 E

X

1/81

HI = 4.95

DIKE

81-94

H X

Z X

S. D

758

81-94-1

345-07-17 102-58-33

530.42

759

81-94-2

345-48-14 108-30-36

515.51

760

81-94-3

346-40-45 114-31-16

510.53

761

81-94-A

348-09-30 115-54-14

510.93

762

81-94-5

348-51-36 118-34-51

513.47

763

81-94-6

348-31-44 126-19-30

529.30

764

81-94-7

348-26-31 128-10-06

514.76

765

81-94-8

344-19-00 95-51-09

553.95

766

81-94-9

343-59-00 92-15-50

594.22

767

81-121-1

342-33-53 80-23-49

936.32

9/12/81

13

RIVER

LEVEL

SHOT

6.5'

HP

B1-94 CONT

HX

VX

- S.D.

768

B1-121-2 344-91-1078-35-12

846.88

END OF DIKE LOCATION

9/12/81

14

HI=4.13

EAST TRAVERSE

T @ 32-333

31-304

1

D

0

00

R

180

~~179~~

00

32-332D

D

101

40

R

281

39

31-304

2

R

90

05

D

270

05

32-332D

R

191

45

D

11

45

32-332D

T

98

05

D

M

97

48

F 5001.696

L

97

31

F 5001.699

M 1524.519

T

261

54

O .026

R

M

262

11

L

262

28

E. CHRISTIANSON T

J. KERR M

9/13/81

T2-161474

3808 A

15

52°F

07.3 INCHES MERCURY

03 03 03

04 04 04 63.5

SKETCH ON PAGE

52.5

03 02 02.5

29

50 50 50 56.25

30 30 30

34 36 35 32.5

48

18 18 18

22 23 22.5 20.5

MX = 101°39'50.4"

36 37 36.5

23 23 23

MZ = 97°48'36.8"

18 18 19

HP = 4.40

04 03 03.5

07 07 07

27 27 27

H1 = 4.73
69

EAST (CONT)

π @ 32-332 D

32-333 1 D 0 00

R 180 00

32-332 E D 265 07

R 85 07

32-333 2 R 90 05

D 270 05

32-332 E R 355 12

D 175 12

32-332 E T 99 02

D M 98 45

F 832.413 L 98 28

F 832.416

M 253.720 T 260 57

R 0.002 R M 261 14

L 261 31

9/13/81

16

121111.5 VARY SPONGY SATUR

050505.5 18.5

53.5

020403

020001 02

283129.5

282828.5 29.0

57.75

252625.5

M 2 = 265° 04' 55.6"

282828 26.75

33 34 33.5

03 03 03

101311.5

M 2 = 98° 45' 24.7"

020001

101010

HP = 4.38

242223

444544.5

EAST

32-332 D (CONT)

32-333

T 82 26

D M 82 09

L 81 52

NO DISTANCE

MEASURED IN THIS

T 278⁷ 32⁽³³⁾

DIRECTION

R M 277 50

L 278 07

HI = 485

T @

32-332E

32-332D 1

D 0 00

R 179¹² 59

32-332

D 34 31

R 214 31

32-332D 2

R 90 05

D 270 05

32-332

R 124 36

D 304 36

9/13/01

17

39 39 39

24 23 23.5

12 14 13

MZ = 82° 09' 34.2"

HP = 8.00

59 00 59.5

22 22 22

29 29 29

05 06 05.5

55 54 54.5 00

02

02 05 03.5

01 00 00.5 02

36 36 36

32 31 31.5 33.75

1.75

38 38 38

32 34 33 35.5

MX = 34° 31' 01.7"

EAST

32-332 E CONT

32-3320

T 81 34

D M 81 17

F 832.321 L 81 00

F 832.321

M 253.692 T 288 24

O 2.00 R M 278 42

L 278 59

32-332

T 73 27 (26)

D M 73 09

F 722.853 L 72 52

F 722.859

M 220.292 T 286 32

O 0.000 R M 286 49

L 287 06

9/13/01

181

49 50 49.5

40 41 40.5

22 23 22.5

59 57 58

04 04 04

12 11 11.5

00 59 59.5

45 46 45.5

39 38 38.5

34 34 34

51 48 49.5

58 57 57.5

ME = 81° 17' 46.5"

HP = 4.28

ME = 73° 10' 00.4"

HP = 5.01

EAST / WEST

H1 = 5.52

T @

32-332

32-333 1 WEST BS D 0 0.0

R 179 59

32-3320 WEST FS D 206 15

R 26 15

32-331 EAST FS D 201 07

R 21 07

32-332E EAST BS D 297 17

R 117 17

32-333 2 WEST BS R 90 05

D 270 05

32-3320 WEST FS R 296 20

D 116 20

32-331 EAST FS R 291 12

D 111 12

9/13/81

19

SKETCH ON PAGE 29

020202

555655.5 5875

8.25

080808

060606 07

222121.5

212221.5 21.5

30.75

535252.5

5355.54 522.5

292929

282828 28.5

13

434343

394140 41.5

535152

505150.5 51.25

29.75

WEST TRAVERSE

EAST TRAVERSE

M X = 206° 15' 10.6"

M X = 201° 07' 22.8"

EAST / WEST

32-332E EAST BS R 27 23

D 207 23

32-332E T 107 09

D M 106 52

A 722.889 L 106 35

F 722.879

M 220.336 T 252 50

σ .000 R M 253 07

L 253 24

32-332C T 92 03

1891.791 D M 91 46

F ~~108~~ L 91 29

1891.787

M 576.622 T 267 56

σ .007 R M 268 13

L 268 30

9/13/01

20

26 26 26 MAX = 297° 17' 53.0"

17 15 16 21

39 40 39.5 EAST TRAVERSE

29 31 30 ME = 106° 52' 38.1"

21 21 21

HP = 4.58

09
+5 07 08

14 14 14

20 20 20

25 27 26 WEST TRAVERSE

17 18 17.5 ME = 91° 46' 21.5"

04 05 04.5

HP = 4.54

19 19 19

33 32 32.5

48 47 47.5

WEST

$$H1 = 4.83$$

②

32-332C

32-332

1

D 0 00

R 179 59

32-332B

D 70 31

R 250 31

32-332

2

R 90 05

D 270 05

32-332B

R 160 36

D 340 36

32-332

T 271 27

R M 271 45

L 272 02

①

T 88 31

D M 88 14

L 87 57

9/13/81

04 05 04.5

51 51 51 57.75

6.5

07 08 07.5

01 01 01 04.25

39 39 39

37 37 37 38

39 39 39

M₂ = 70° 31' 03.4"

38 37 37.5 38.25

42 43 42.5

11 11 11

01 59 00

51 51 51

46 45 45.5

M₂ = 88° 14' 52.8"

35 33 34

WEST

 π @ 32-332C (CONT)

32-332B

T 87 41

953.774

D

M 87 23

F 553.774

L 87 06

F 553.774

M 290.714

T 272 18

1.003

0.001

R

M 272 52.35

L 272 52

HI = 5.11

 π @ 32-332B

32-332C

1

D 0 00

R 180 00

32-331

D 301 14

R 121 14

32-332C

2

R 90 05

D

32-331

R 31 20

D 211 20

9/13/81

22

00 01 00.5

41 41 41

ME = 87° 23' 58.7"

37 36 36.5

HP = 4.70

41 41 41

47 46 46.5

59 58 58.5

04 05 04.5

112 13 12.5 08.5

35

41 42 41.5

45 46 45.5 43.5

33 34 33.5

44 43 43.5 38.5

MA = 301° 14' 33.8"

11 11 11

11 11 11 11

WEST

32-3320

	T	92	56
D	M	92	38
	L	92	21
	T	267	63
R	M	267	20
	L	267	38

(55)

32-331

	T	89	36
D	M	89	1518
	L	89	01
F	2594.949		
F	2594.955		
M	790.945	T	270 23
G	.007	R	M 270 40
		L	270 57

9/13/81

23

00 59 59.5

48 49 48.5

40 41 40.5

MZ = 92°39'00"

38 38 38

50 50 50

01 00 00.5

03 02 02.5

51 50 52

44 46 45

MZ = 89°19'03.5"

HP = 4.00

39 35 34.5

50 52 51

53 53 53

HI = 4.75 T WEST @ 32-331

32-332B D 0 00

R 180 00

32-331B D 299 33

R 119 33

32-332B R 90 05

D 270 05

32-331B R 29 38

D 209 38

32-332B T 90 57

M 90 39

L 90 22

T 269 02

M 269 19 20

L 269 37

J. KERR
E. CHRISTIANSON

CALM
CLEAR

T2-
3808-A
9/14/81

24

04 01 02 5

03 03 03 02 7.5

9.25

14 14 14

09 11 10 12

25 25 25

28 29 28.5 26 7.5

33 32 31.5

MX = 60° 26' 52.4"

34 34 34 32 7.5

05 06 05.5

58 56 57

MZ = 90° 40' 01.2"

49 48 48.5

HP = 4.73

42 43 42.5

00
54 53 59.5

00 03 01.5

WEST
T @ 32-331 CONT

32-331 B		T	90	59
	D	M	90	42
F 1246.270		L	90	25
F 1246.287				
M 379.862		T	269	00
Q .002	R	M	269	17
		L	269	39

3536 355

1920 19.5

1314 13.5

1819 18.5

3028 29

3536 355

$MZ = 90^{\circ} 42' 27.6''$

$HP = 4.64$

HI = 5.14

WEST

@ 32-331 B

HP 4.81

32-331 1 D 00 00

R 359 35

32-330 R 180 00

179 35

D 180 00

32-331 2 R 90 05

D 89 41

32-330 R 270 05

D 269 41

32-331 T 89 39

D M 89 22

L 89 04

T 270 20

R M 270 37

L 270 54

7 J REED
E CHRISTIANSON

9/4/81

24M
CLEAR

TZ
3808-A

26

10 09 09.5 5.75

48 48 48 47.25

02 02 02

47 46 46.5

47 46 46.5

02 02 02

28 29 28.5 31.0

15 12 13.5 5.5 MK = 359'35'43"

33 34 33.5

17 18 17.5

21 20 20.5

08 09 08.5 ME = 89°22'15.2"

52 56 54

HP = 4.40

25 28 26.5

37 40 38.5

47 47 47

WEST
 * @ 32-3313

32-330

T 80 35
 36

D M 80 18

F = 4658.909 L 80 01

F = 4658.929

m = 1417.904 T 279 24

σ 0.007 R M 279 41

L 279 58

CON 7

25 22 22.5
 26 00 00

27 10 09 M MZ = 80° 18' 25.3"

09 09 09

HP = 4.4

14 11 12.5

23 21 22

27 30 29.5

H1 = 4.31

WEST
32-330

32-331 B 1 D 00 00

R 180 00

31-306 D 16 14

R 196 14

32-331 B 2 R 90 05

D 270 05

31-306 R 106 18

D 286 (19)

32-331 B T 99 59

D M 99 42

F 4651.995 L 99 25

F 4651.999 932

M 1917.935 T 260 00

O 0.007 R M 260 17

L 260 34

NO DISTANCES OR ZENITH X'S MEASURED TO

31-306

J. ALPER, T. CHRISTIANSON

14/81 T2 3808 A 28

19 19 19 17.75

22 21 21.5

13 13 13 10.75

09 08 08.5

11 11 11 11.5

10 12 11

57 57 57

05 05 05 01.0

38 39 38.5

26 26 26 ME = 99°42'38.5"

23 24 23.5

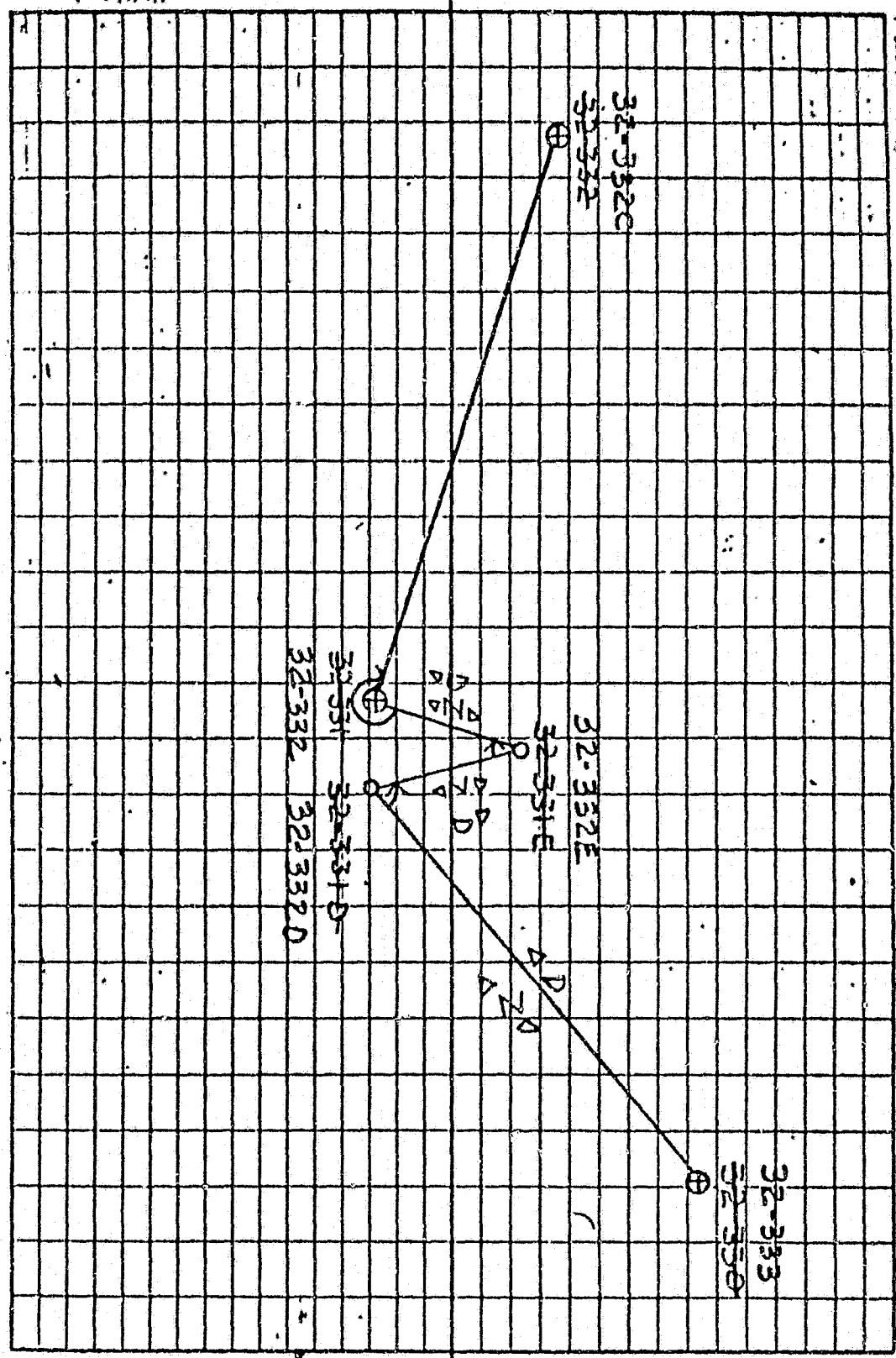
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00 10 01 00.5

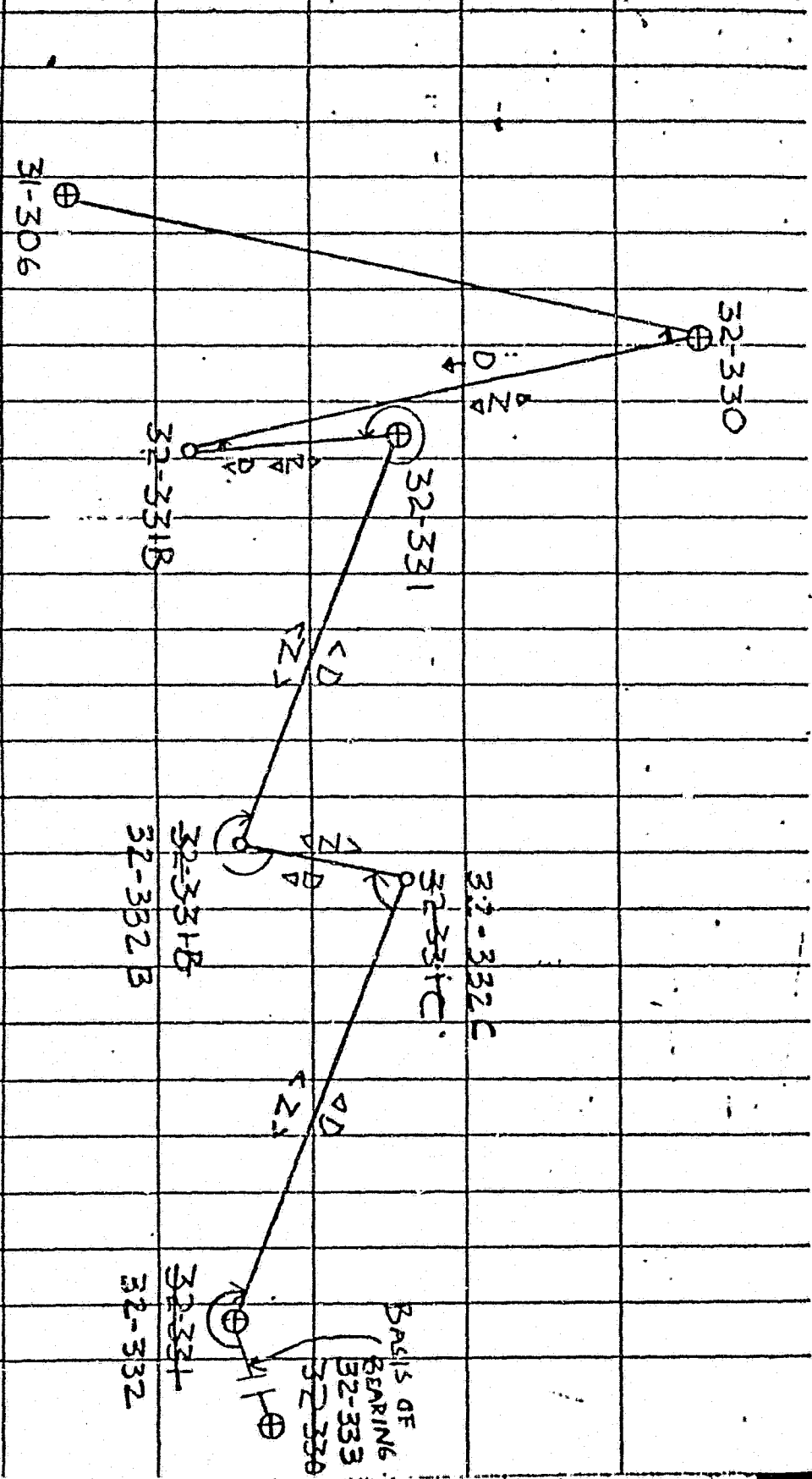
16 16 16

21 20 20.5

EAST TRAVERSE



WEST TRAVERSE



AAE BOOK 17

4-22-81

It's a clear, sunny, warm day.
Arrived at Wataana. Will fly to Devil
Canyon & begin set-up for photographing
the left abutment cliff.

34 17

Started on the $\frac{1}{3}$ end of the base line
and will work $\frac{2}{3}$. Will discuss
locations for a top & bottom base line.

Station #2 Bottom Base line

top of cliff = 170'

Bot of cliff = 340'

- start at base of talus slope &
photograph to $\frac{5}{8}$ panel

Elev. 1080' @ 200'

Station # 2 Top

Elev. 1102' @

site contour ...

2° 4'

c/L
X

15°

32°

photograph

would need to brush
good site

Station 3 top right below BH-2

Elev. 1166 @ 2° 14'

d/s edge of talus slope d/s
to c/L, good visibility

minor brushing

BH-2 1192' @ 2° 22'

Station 4 d/s of BH-2

ELEV 1159' 2° 35'

right across from c/L, panel marker
~ 13° top

~ 34° Bottom

- good correlation w/ Station 3

Station #6

ELEV 1155' @ 3²⁵

Directly across from the 'A' frame.
- good vantage point on the other
side of a ridge going upslope. Need
another station on the other side of
the ridge between here and STA #4.
A lot of brush here, two clumps
of two or four trunks. Could fall
a couple of times beneath here also.
In any case will have trees blocking
the lower part of the canyon wall.

12° top

32° Bottom

STATION #5 1/2 side of ridge

ELEV 1143' @ 4⁰⁷

Good location in between #4 & 6.
Brush trees at edge. Minor
interference of trees right below, i.e.
affecting the bottom of the cliff.
Can see the joints at ~ 330°
very nicely at C/L

16° top

35° bottom

Return to BH-2

1143' @ 4³⁵

There is a vegetated steep chute
between STA #4 & #5. Definitely a
too close to very closely jointed fracture
zone where exposed, some is not
exposed. Use a rope & one could
go down this chute, probably right
to the river. Don't follow the
flagging down to station #5

Go in fact d/s then go down slope
 Distance between STA #4 & #5 and
 #5 & #6 is in the order of ~100'
 Have to go upslope from #3 to
 #4 and then over to #4. Go
 up slope from #4 to #5.
 May be able to traverse to #6
 without going up slope but am
 unsure.

Up to 3⁰⁰ sun high in sky
 and left abutment is in shade
 @ 4⁰⁰ got a little sun on the
 rock face not much.
 Base line is in the sun all
 day.

Set up STA #1 Bot to go
 with STA #2 Bot

PLANS FOR THURS:

- A. SET UP STA #1 & #2 for the
 BOTTOM BASE LINE AND CLEAR.
 HRS. 1.5
- B. CLEAR STA #2 through #6 on the
 TOP BASE LINE
 HRS. 4.0 to 4.5
- C. PHOTOGRAPH IN COLOR AND IN
 BLACK AND WHITE.
 HRS. 5.0

9 hours

4-23 5

day photographing the left abutment.

Then the day with brushing each of the sites. Later returned to each of these sites for photographing the opposite abutment. Abandoned STA #2 BOT and STA #6. STA #2 BOT was not necessary as there was enough overlap already. STA #6 was too difficult to get to with a chain saw.

STA #3

Had three vertical lines of photographing with ~50% overlap. The last shot of my personal roll was the center/horizontal frame. Proceeded to take three photos of each frame; one at the correct f-stop, one at a lower f-stop and one at a higher f-stop number,

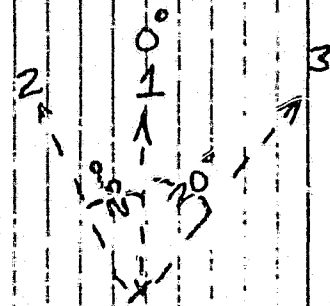
in that order respectively. Always did the center vertical line first, then the vertical lines proceeding upstream followed by the lines in the $\frac{4}{5}$ direction.

ROLL #1 1-36

ROLL #2 1-10

#13 is a single shot for more vertical overlap

#31 is a duplicate, may be no good, return for B&W



STA #4

Four vertical lines one $\frac{4}{5}$ and two $\frac{4}{5}$. Same procedure as STA #3, #2, #11 is the center frame.

Roll #2

12-28 or 29

center line

28-36

Roll #3

1-12

12-27

28-36

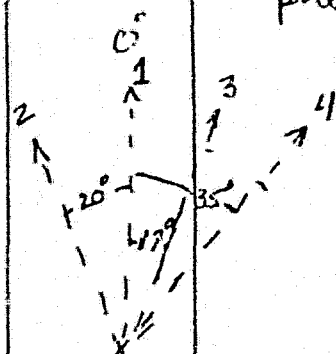
1/3 line

1st D/S line

2nd D/S line

- #3, #36 there is no one up & one down for this frame.

B&W Roll #1 same lines as the color film with only 1 shot per frame.
1-24 w/ one extra shot that is a duplicate. No center photo's for the B&W



STA #5

B&W Roll #1

25-36

center & 1/3 lines.

Color

Roll #4

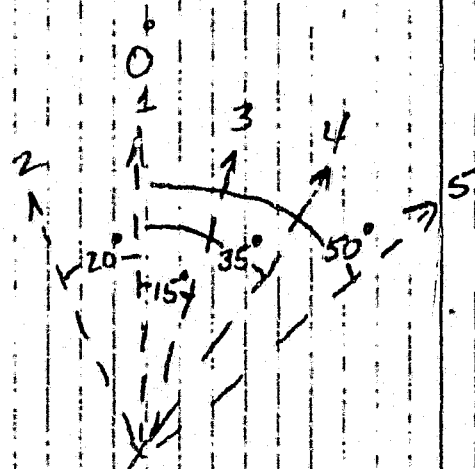
center, 1/3 line, and 1/2 of 1st D/S line

Roll #5

1st, 2nd, and 3rd D/S lines plus two vertical and one of the river.

B&W Roll #2

1-10



STA # 3

Returned to for B & W

B & W Roll # 2 11-24

STA # 2 TOP

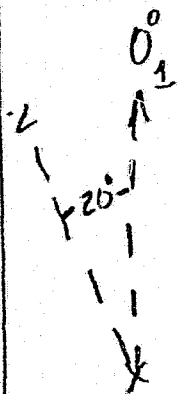
B & W Roll # 2 25-35

COLOR

Roll # 6

no more
frame,

1-12 single shots
three shots for one



STA # 1 single shots

COLOR

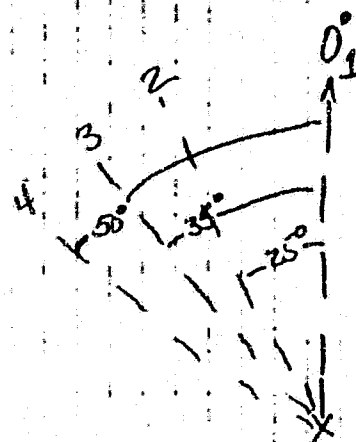
Roll # 6

13-31

then ended film

B & W Roll # 3

1-20



Upon leaving Devil Canyon
photographed the cliff face at the
east end of the pond which faces
northeast. All vertical photo's but
the last one

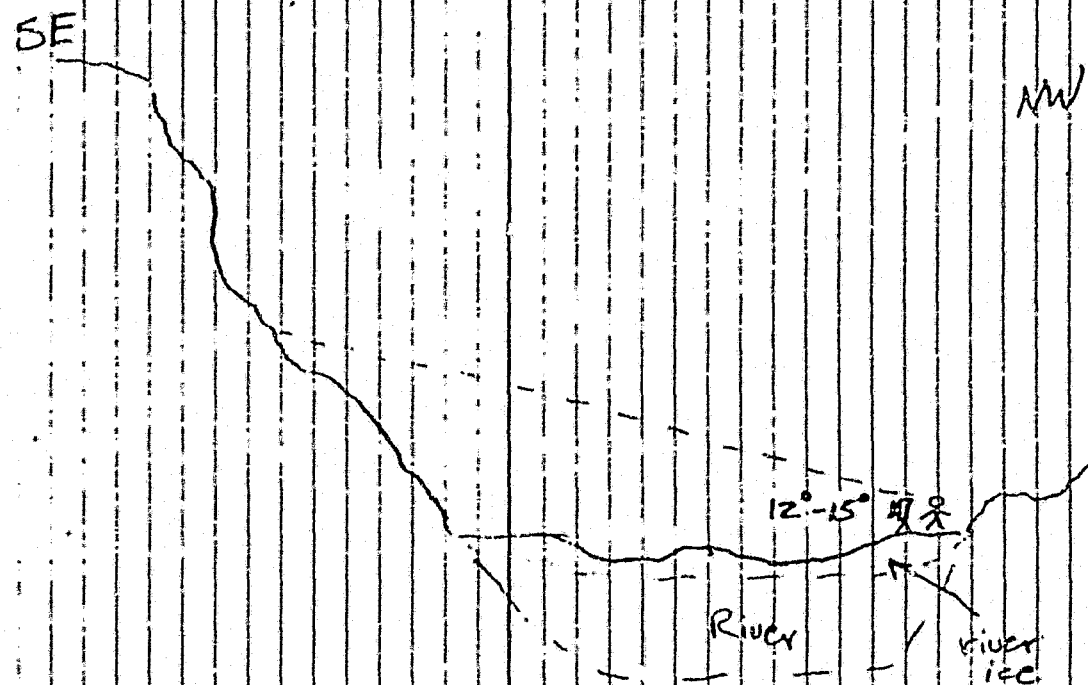
B & W Roll # 3 20-33

ELEVATIONS FOR THE DAY

11 hours

3-24-81

It's still another clear, sunny day.
Will begin the morning by photographing
the left abutment from the river ice.
It will be a continuous vertical frame
strip, beginning up and proceeding D/s.



Roll # 7 = 13 STATIONS(?)

1st frame 1 shot
 2nd frame 2 shots
 3rd frame all three
 4th frame all three

"

- end with two shots on one frame,
 next one comes on the next roll, #8

Roll #8

Roll #9

starting with #10 only two
 shots per frame; at the correct
 f-stop & etc

#10, 11

#12, 13

#14, 15 c/L of dam

#28 and on, only one shot

- panorama on the last station

#33-36 with the last one

being a duplicate
 of the c/L begins getting closer to
 the opposite bank

Will proceed back taking B&W
 pictures of what was just beginning
 d/s and working upstream

B&W Roll #4

1-36

B&W Roll #5

1-78

Photographed the right abutment from
 the helicopter

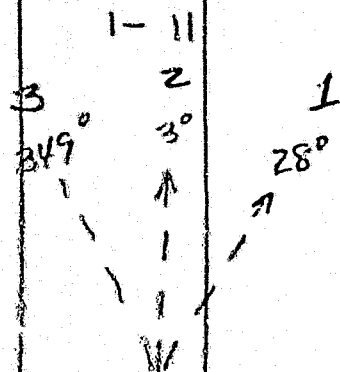
B&W Roll #5

1-36

Proceed to Devil Canyon,
 photograph the right abutment
 from on top of the left abutment

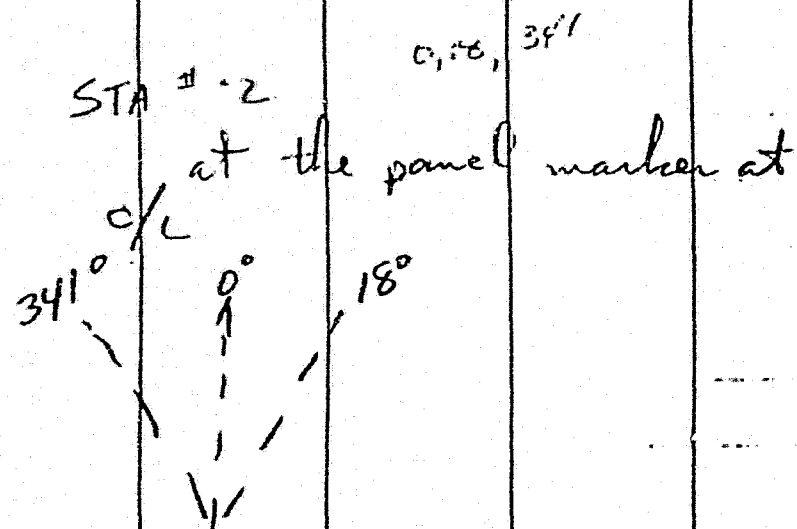
COLOR Roll #10

STA #1



Down up to 35°
first picture was of the dilee

STA #2

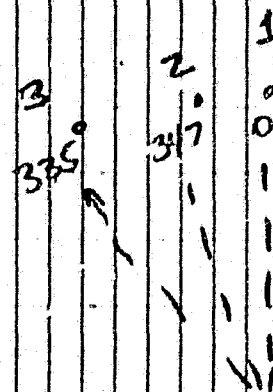


#12 - 24

Down to 45°

STA #3

Down to 38°, station is between
the two 'A' frames but ~ 65' near
the 1/5 one.



#25 - 36

5-20-81

Begin the summer mapping program. J. Heinzen, K. White, and I have arrived in the field. We will begin in Devil Canyon by working on the north abutment after looking at the core at BH-7.

It's a mostly cloudy and windy day.

BH-1

A

109'

342°

+35

310°

D 81-46

B

81'

276°

D-81-46 (A)

Outcrop upslope of BH-1, ~50' high, 100' across. The reddish medium gray, fine grained argillite becomes slightly phyllitic in places.

Oxidized, slight weathering on outcrop surface.

Joints:

Major 66° 69° SE } 6" to 2'
 75" 65" SE } smooth, plane-
 irregular
 335° 85° NE plane, smooth
 6"

- set could line up with the chute below which is adjacent to BH-1
 Dike joint seen only on the east end of outcrop.

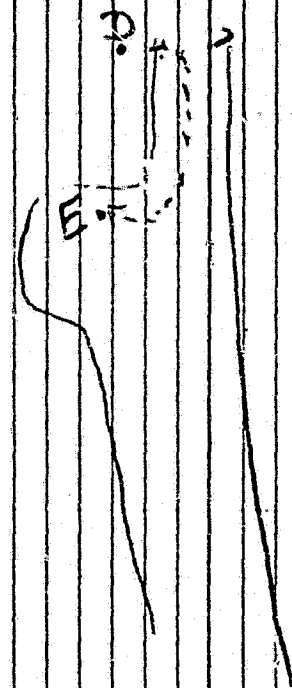
32" 18° N 1/4 4" to 2" over ~ 1"
 - small fractures in outcrop
 irregular, rough

B-C 85' 75°
 C-D 63.0' 85°

STA D

west side of chute at 335°
 lines up w/ highly fractured or dike!

on the left abutment
 going down slope
 D-E 57' ~ 310°



D-81-47
 (E)

Dike intrudes the argillite. Argillite is light to medium gray, fine grained rock. It is well indurated, hard, has clasts of quartz, finer grained, dark gray argillite. Within the dike, the rock

Joints

336° vert } 2"-6" plane smooth
 338° vert }
 45° 22° SE } 8" 2" to 1"
 51° 19° SE }
 22° 81° NW }

is highly fractured. Joint spacing is generally very close. No breccia clay zone visible; could be in the vegetated part of the chute. Dike is ~ 10' wide. It is a light to medium gray fine grained rock with quail edges. Very hard highly jointed.

cont. (continued)

342° 75° NE ave. 8"
359° 84° E 4" - 1"
plane, smooth

Possible orientation of dike is ~ 15° or parallel to the chute

E - F 54' ~ 335°
F - G 59' ~ 335°

G Angular in the 1/2 face, and the rock is polished on the 1/2 side. + visible dark material in the chute will be seen further down

Joints

346° 82° SE trend of 1/2 cliff face at this point in the chute

where the chute meanders. No breccia visible. Dike should be exposed in one of the walls.
G-H 62'

Major { 342° 81° SW 1" - 1"
342° 75° NE plane, smooth
Secondary { Horizontal ≥ 3'
46° 81° SE rock, 2'
rough, plane

Dike down here contains small chunky quartz, thin like the material one up above. Rock chips in bag.

H - I 100'

I 20' in photo. #4
 dark grey to black, fine grained
 slightly pitted, dark grey to charcoal
 black, compact on faces, minor
 in matrix.

June

55° 54° SE smooth, fine
 over 1.5' generally not
 well developed, ~ 4 joints
 together, ~ parallel to
 bedding (?)

230°	vertical; 11 to chute
294°	26° SW 2' to 5'
	aver ~ 2'
	yellow, smooth

to the shear or joint with
residual soil

45°	SE	6'
oxide	silty	clay

with flat sig. pcs of
on d/s face 1 rock. Not seen

II-V 67' down the chute

Dark gray slightly phyllitic, laminated,
but not well developed - parallel to 54°
 74° SE set. Not very many well defined
joints. Lamination shows up on weathered
Joints:

54° 74° SE 3' to 3+'
very wide & irregular pattern
324° vert. } 5' to 3'
324° 81° NE } curved, rough

surfaces - is either weakly foliated and breaks along or bedding

Out of chuto

J-K	30°	- 88'	(7)
K-L	27°	94'	
L-BH-1	27°	+ 51'	

BH 1 to M

315°

66'

-48 (M)

Outcrop is 20' high and 60'
 fine, thin, crystalline, charcoal gray
 thin, quartz, crystalline, phyllic rock
 slightly weathered surface, competent.

46° 26° NW : aver. spacing 8" to

47° 8° NW

213° NE irregular rough
 341° 81° NE plane, smooth

71° 74° S face of outcrop
 curved, rough

BH 1 to M

327°

320°

59'

118'

N to O

310°

67'

TOZ - Range finder did not work very
 well, vegetation is much too thick. Will
 try using Brunton and tape. The chute
 traversed down slope today had dike material
 exposed at the top & further down in the
 chute, didn't find very much exposed on the
 walls or in the chute itself. Looked in
 BH-1 core but did not find any indication
 of the hole intersecting the dike.

HRS. 14.5

5-21-81

Snowed last night, mountains are covered. It's mostly cloudy and cool this morning. Henson, White and myself were dropped at BH-1 in Devil Canyon. The clouds will probably burn off.

(actual is 1415')

BH-1 1120' at 72° at 5.5°

BH-1 to A	96'	320° (327°)
A to B	75'	5° (16°)

D-1-1/2 (13)

Outcrop ~ 20' high and 80' long

Elevation

1193' 7 " @ 50°

Charcoal gray, fine grained, slightly phyllitic argillite. Weakly developed to no foliation. Contorted

quartz veins. Joints are iron stained. Generally hard, outcrop is slightly weathered, competent.

Joint 3	346°	78° NE-E	over 8', 2" to 1'
* ngsd	350°	82° E	plane, rough
subhorizontal secondary	295°	34° N-NE	
* *	37°	20° NW	3"-2' plane rough
* *	19°	vert	whisking
* *	28°	vert	outcrop face in one spot

B to C 75' (12°)

D-8-50 (C) Tagged

Outcrop is vegetated and covered somewhat ~ 70' long and 10'-2' high

Elev. 1230' at 81° @ 50°

Dark gray fine grained argillite and the charcoal gray slightly phyllitic rock. — not much of a sheen, no foliation. Phyllite and argillite. Argillite is on d/s end of outcrop, hard, massive,

compact, fine-grained rock is thinly laminated.
hard, compact.

Joints

52'	82° SE	irregular pattern
346°	76° E-NE	area 2' to >2'
334°	77° NE	irregular, rough
318°	20° NE	plane, smooth

6' or several feet.

Top is slightly weathered

C to D

80' 265°

C to E 155'

(N to E 60' 74°) 264°

D-81-51 (D)

Trend of outcrop is 330°, c. 10' - 20' high and ~120' long

(E)

81-51

(E)

2-50

Dike ~ 1' wide at 285° 75° S
a gray fine gr. rock + no mafics
felsic dike

Outcrop is of the dark gray argillite
the charred gray phyllitic rock

Joints:

secondary 67° 63° SE curved plane
1' to several feet

dominant
in outcrop

316° 7° NE plane, rough
6" to 2.5' area 2'

Laminated bedding
278° 55° S

D-81-52 (E)

Large low outcrop which begins here
and stretches in a N/S direction for
several hundred feet.

Averages 20-30' high and is 345' long. Outcrop is very massive, has a

blocky texture, competent. Thin slightly weathered surface on the outcrop. Dan & I were here last year, did we do part of our joint station here? The rock is primarily a siliceous dark gray to dark gray, fine grained argillite, slightly phyllitic in a few places. Argillite contains occasional quartz grains, fine to med. size. Rock is hard competent.

Outcrop trends ~ 65° and ends at a NW trending cliff face. Jointing is moderate close to areas which are close to very closely jointed 150' - 220', 0' being 1/5 end of outcrop.

Elev. 1230' @ 9²⁵
east end of outcrop

0' - 50'
Very blocky
Jointing

* ② * 336° 84° NE plane, smooth
8" to 1.5'

* secondary 82° 65° N, rough, irregular,
sub-parallel to cliff face

* 55° 12° SE plane, smooth
2' to 2+

Some of the NW joints are open to 6" but generally less than 1". Joints 1/2 outcrop face - Fe & CO₂ staining

⑥

Joints
* { 309° 17° SW, slightly curved,
275° 17° S smooth

* { 340° 76° NE 4" to 1.5'
338° 88° NE plane smooth

* 82° - vert cliff face

Roll K8 #0 & 1.

⑦ ~ 150' to 225' Close to very
closely fractured

352° vert

335° 71° NE

* 279° 25° S

271° 27° S

195° - 350° joint open 3"

(1) ... the inclusion of
 a piece of ... stellite rock
 ... trace of possible ...
 * 547° 77° NE plane, rough
 1' - 2'
 63° 80° NW plane rough
 2' - 8' ... 5'
 cliff face, rough ...
 * 280° ... spacing ... 1.5
 plane, smooth to rough

significant feature though.

This outcrop provides a good cross section
 of ... features crossing the dam site
 area. No shear ... or other bad structural
 features were encountered.

On top of the east end of the
 cliff ... relief joints parallel to the
 cliff face 70° & 75°. Opening of
 6" and 2". Blocks detaching.
 Elev. 1240' @ 10⁵⁵
 rock height here is ~15' (no more than
 20')

E to F	100'	275° (276°)
F to G	100'	275°
G to H	170'	8° bearing
	{ 100'	12° upslope
	{ 70'	33° upslope

D-81-53 (H) Tagged

Outcrop is stepped ~ 110' long
 and two steps of 20' high, total 55'
 Elev. 1320' at 11⁵⁵ at 54°

25' higher
 40' below

Outcrop is composed of the dark gray
 fine grained argillite. Has quartz eyes
 up to 1/8" in diameter. Generally hard
 to very hard, blocky, competent. Jointing
 is moderately close. Some NW trending
 joints are open to p. open, ^{on west end} Get rock fragments
 within the argillite, ... 1" to 2". Composed
 of quartz, phyllite(?) and a medium grained
 stellite rock. Fragments are angular to
 subrounded. Rock is conglomeratic or lithic
 graywacke. V. hard, competent, difficult

no get any sample, Heavy lichen covers
slightly weathered surface

Joints:

* 345° 74° E plane, smooth
6" to 2' aver. 1.5'

* secondary 82° 17° S plane, smooth
6" to 3', aver

* 74° 81° E curved, smooth 3'
cliff face

347° 87° E - east facing slope of
outcrop, it heads up slope.

332° 77° E

Large blocks 5-8' long, on downslope
vegetation covers. Quartz pebbles occasionally
detached.

G to I

200' at 275°

I top of gully
1244' @ 125° @ 55°

Going down gully

I to J 100' 333° (153°)
44° slope

Check 61-31

J to K 100' 336° (342°)
43° slope

- station 36' E of traverse

D-81-54 (K)

Walking down along the SW facing
cliff face. It is 25' to 30' high

Elev. 1117' @ 14

Reddish dark gray, fine grained argillite.
Hard, competent. Intruded by a dike
which is parallel to the cliff face. It
is a light gray fine grained rock. Few
spec of mafic mineral. Some small halo
of clear quartz ~ fine to medium grained.
Dike material is exposed off and on again

Joints:

* 83° 76° S 6" to 10' aver. 6'
plane, smooth

* 271° 22° S

along this face. No fracturing or incompetency
associated with. Sampled. Same material
as that seen in a chute yesterday, 81-47

Outcrop to the west

* 49° 51° SE ~ bedding

measuring d/s

K to L 100' 32° (342°)
32° down slope

near
Hand near the dike argillite, banded
Elev 1075 @ 2°

T. & P. dike at this level, may be
32° 15° SE
an up c. or thickening. It Gray
fine grained, lots of quartz
hard, competent

L to M 120' (311°)
15° down slope

I-01-26 (M)
Have the med gray, fine grained
argillite and the light gray fine
grained dike with quartz veins. No mafics

Both are hard, competent, slightly
earth.

Joints all are planes & smooth
* (334° 82° NE possible trend
of dike along a major joint
spacing in dike P to 2', cliff face
Major * 84° 75° N 6" to 1.5', tight
to open
* 323° 17° SW few inches to
several feet

Elev. 1047' @ 2° SE

M to N 60' (145°)
34° down slope

N to O 100' (21°)
35° down slope

O to P 35' (332°) (320°)

P to Q 55' 283° (278°)

D-81-57 (Q)

light gray, fine grained silt. Small
quartz grains present. Very hard, competent.
Grossly 10' wide trending 330° - 340° .
Joint measurements taken on cliff face
where deformation is exposed

Joints

- * East West 70° N plane, rough,
spacing 1" to 1', aver. 6"
- * 10° 15° W plane, rough
spacing 1" to 1', aver. 6"

Elev. 947' @ $4^{\circ} 20'$ 55° (?)

Q to R 75° 321° (339°)
 23° downslope

R to S 275° 65°

D-81-58 (S)

tagged

On a bench, parallel to slope, cliff
face is ~10' high. The reddish dark gray
to dark gray, fine grained argillite.
Hard, competent.

Elev. 911' @ $4^{\circ} 48'$ @ 55°
~1245' or 1206'

JOINTS:

- * 66° 75° NW, smooth plane, aver. 1'-3' 4° to 6°
 - * 345° 85° W - 85° E plane, smooth
 - $1/2$ " - 10' aver. 1'-2'
 - some open to 3"
 - * 50° 35° SE plane-curved, smooth
 - zones 2' to 6" generally 3' to 4'
- all are dominant

S to T 41° 74° ()
 30° upslope

T to U 56° 23° (28°)
 25° upslope

D-51-29 (U)

Outcrop is long, up higher on the bench
 a 15' high consists of the dark gray
 fine grained argillite. Blocky, broken,
 competent. Argillite contains some quartz
 Fluv. 953' 5⁰⁹ @ 55°
 Photos K8 "2 no good, #3

Joint.:

* 343° 1° E plane, smooth.

6" to 2' aver. 1.5'

one is open 2"

331° 67° SW plane, rough

** 89° 1° S plane rough

6" to 8' aver

fractures

68° vert, cliff face, open joint

pebbles and argillite fragments. Joint
 spacing is moderate close to wide. Detached
 block - along joint II to cliff face
 low color is not found on the
 down slope with vegetation grown over
 them. Arg. pebbles are shattered

U-V 20' going across slope 289°

V-W 60' 65°
 30' fracture zone 3
 340° vert 1'-2' zone
 width 2-3" spacing

W-X 60' 64°
 52° up slopeX-Y 200' 16°
 25° up slopeY-BH-1 90' 0°
 14° slope

BH-1 112' @ 60° @ 54°

TOP - long SW facing cliff face, that
 stretches down slope, like material
 the same as that which was found in the
 chute yesterday.

Plotted 5-29, 5-31
 HRS 13.0

5-22-81

It's a mostly sunny day, cool this A.M. White is waiting for Crawford to come in, later they will work at the point bar/fan. Hansen and myself were dropped at the cleared site d/s of BH-1 but higher. Will work d/s and down slope from here.

Photos: mosaic, 1-3-4

Elev. 1520' @ 7²⁰ @ 44°

A-B 100' 71° (70°)
12° downslope

D-81-60 (B) targeted

114 the east end of this long outcrop
Elev. is at top of outcrop, height is approx

Elev. 1506' @ 7³⁰

35'. Notch ~ 25' occurs in the outcrop, no exposure.

Dark gray fine grained argillite.
Generally moderate hard to hard, moderately weathered on surface, mostly competent

Joints:

* {84/5°S}
secondary

* 68° 72° SE

Equal facing side

plane, smooth, 6" to 4" over ~ 2-3' Calcite filling

plane, rough, quartz filling parallel to the laminated bedding 1" to 2.5' over, irregular difficult to determine here.

* 321° 76° NE plane, smooth, locally very close, but is discontinuous secondary

Contains numerous quartz stringers. laminated bedding is evident due to weathering of outcrop surface, thinly laminated, bed. Depth of weathering of the outcrop is deeper here than in any seen in 1981. Some seen visible in places along the partings, bedding.

B-C 52' 10° (14°)
42° downslope

C-D 65' 62° (62°)
20° downslope

D-81-60 (cont) River facing slope.

Thinly laminated dark gray argillite
fine, competent

Joints:

ψ { 286° 28° N plane, smooth
301° 17° NE 6" to 1.5' aver.
6" - 6'

* { 7° 28° W plane, smooth
6° 67° W over 3' to 34'

0° 21° E 1 1/2" quartz filling
plane rough, v. wide
spacing

74° 61° S cliff face
irregular, rough
2" to 10" ?

D-E 80° 208° (29°)

37° down slope

41° up slope

Elev. @ E

1418' @ 843 @ 53°

E-F 92'

231° (57°)

40° down slope

36° up slope

D-81-61 (F) tagged, ARGILLITE

Going down slope along the outcrop
Cliff exposure to east is 10' high - to bed
Elev. 1361' @ 95° @ 55°

The cliff face subparallel to bedding
extends up the face

Reddish dark gray fine grained
argillite which has a layered
sequence alternating with a white
quartz. Also quartz sand particles
in the argillite - stretched parallel
to the weakly developed / visible
laminated bedding (sampled). Hard
to very hard, slightly weathered outcrop
face, competent
~ 25% - 35% quartz

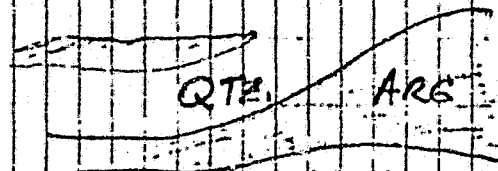
Joints: (6)

* 331° vert. plane, smooth, wide

Joint spacing est 3' - 12' (?)

331° 57° NE curved plane smooth

* 90° 17° S plane, smooth, widely
spaced plane 5' - 8'



* 68°

60° SE cliff face, approx
parallel to laminated bedding
plane-rough 2" - 2' over 1'

14°

74° V

plane, rough

5" to 1.5' discontinuous

② Rock is foliated? (looks like slicks), see on
W laminated face, but can't trace from one face to another.
UPSLOPE E

rk
slabs

③

Veg
COVERING
rk

④

ridge

Downslope

⑥

Dark gray & charcoal gray, very fine
grained slightly phyllitic rock. Some
dark gray fine grained argillite, interbedded
with. Rock breaks off in thin sheets or
slabs. Depth of weathered rock ranges
from < 1" to several inches probably.
Generally hard, slightly weathered,

Joints: @

0° cliff face exposure

281°

65° N. plane smooth

*

325°

75° NE plane, rough

2' - 3' spacing, (some are p. open)

*

66°

54° SE subparallel to bedding; plane, smooth

2" to 2.5'; over 1.5'

4°

vertical cliff face

competent didn't see any quartz over
on this side.

To this point going down slope the
rock has been good, no problem areas.

F-G

125°

189°

(6°)

± 47°

D-81-62 (G)

Continued down slope along the cliff/
ridge orientated ~ 0°. Primarily the
dark gray, fine grained argillite, has

a slight slope along some of the laminated
interbedded with
quartz veins & stringers
throughout. Generally hard, competent,
slight weathering, weathered on outcrop

Jo. 175

* 1 66° 59° SE plane, smooth
quartz stringers ≈ 2.5
meters; 1"-2" aver. 2'

336° 84° SW plane, smooth
small spacing not repeated
here

334° 60° NE 2" quartz vein
* 61° 21° NW plane rough
1'-6' aver. 4'

surface. Weathered surface has that
characteristic laminated appearance.

Elev.

1295' @ 105° @ 61°

G-H

50'

1°? (20")

42° down slope

1255' @ 111° @ 61°

H-I

35'

304°

(307°)

16° down slope

65'

304°

(307°)

35° down slope

ID-81-63 (I)

Large outcrop cliff face, ridge

Elev.

1206' @ 114° 61°

we are following down. Massive
outcrop of the dark gray fine grained
argillite. Few joints on this outcrop
face 70' long & 20'-25' high. Hard
to very hard, competent, cliff face is
slightly weathered. No bedding plane
clearing.

Joints:

341°

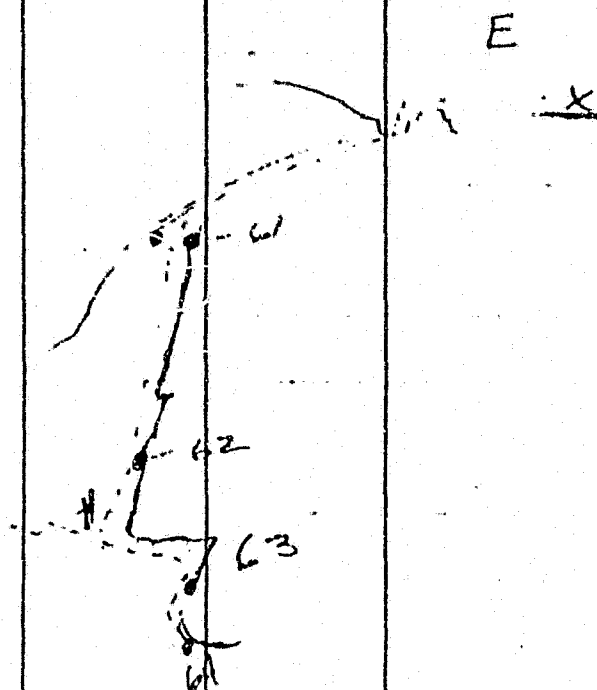
rest: curved plane, smooth

7' to 7 1/2'

289°

79° N small fracture

faces, only ≤ 6 " in length
2" to 4" all over the cliff
face.



Joints (cont)

31°

84° SE

cliff face
curved, rough, carbonate
iron staining

324°

29° SW

plane, smooth
several feet

I-J

52'

6° (5°)
35° slope

D-81-64 (5)

Still the dark gray fine grained argillite. Slightly weathered, hard, competent. Just d/s of 81-23 provides good x-section of joint occurrence. Bedding plane cleavage, but not ~~extremely~~ prominent. Weathered cliff face shows the laminated structure

Joints:

* * 321° 34° SW plane, smooth 2'8"-10'
aver. 6'

* * 320° 85° SW plane, smooth, 1/2"-1'
aver. 6"; cliff face

secondary 358° vert. plane, smooth discontinuous
or irregular spacing

* * 55° 67° SE approx the
bedding surface, 3"-1.5'
aver. 1/2"

Elev. 1200' @ 104°

Through this entire traverse we've been going downslope on approx. the bedding plane surface. Get the feeling that slabs in places have slid down on top of the slatted surface

NW 1/4

SE

mat surface

H

Elev. 1272' @ 14° @ 69°

H-K

100'

258°

(78°)

11° downslope

K-L

44'

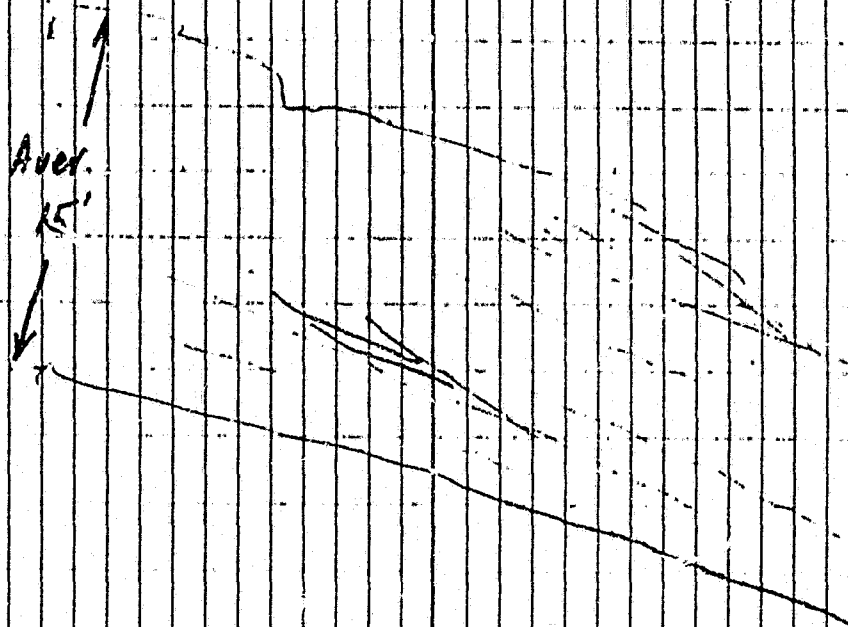
152°

(34°)

35° upslope

D-81-65 (L)

Have a large ridge outcrop with an southwest exposure, as it trends ~ 325°.



The rock is the dark gray fine grained argillite. In an ~ 2' thick section of

the outcrop the dark gray argillite (muds) are interbedded with a yellowish brown, clay. sands. This may occur in other sections of the outcrop. Outcrop face is visible to moderately weathered, only on the surface. Prominent bedding plane cleavage. Weathering seems to have brought out what looks like x-beds, not sure though. Also there are some thin (generally $< 1"$) of shaly weathering along the bedding plane surfaces and very closely jointed zones. ~~are~~ Are weaknesses planes but has any movement or slippage of the blocks occurred along these discontinuities. The rock is slightly phyllitic in places and is foliated (looks like very faint joints).

50° 55° SE bedding plane cleavage; plane to curve smooth

26° 62° NW plane, smooth 4" to 5' aver. $\sim 1'$

5° vert. plane, smooth 2" to 5' aver. 3'

some are highly weathered rotten

sampled Most joints are all weathered. Outcrop is hard, moderately weathered and moderately competent - to much bedding plane cleavage.

* { 45° 50° SE bedding plane cleavage.
54° 51° SE
325° vert. cliff face

K-M 30' 258° (253°) horizontal

D-81-66 (M)

Across the way to another ridge. Dark gray fine grained argillite. Hard to very hard, slight weathered outcrop surface, competent. Weathered surface has the characteristic laminated appearance. Quartz present. Small little fractures $\sim < 6"$ long.

Elev. 1257' @ 248° @

with orientation of $\sim 299^\circ - 318^\circ$

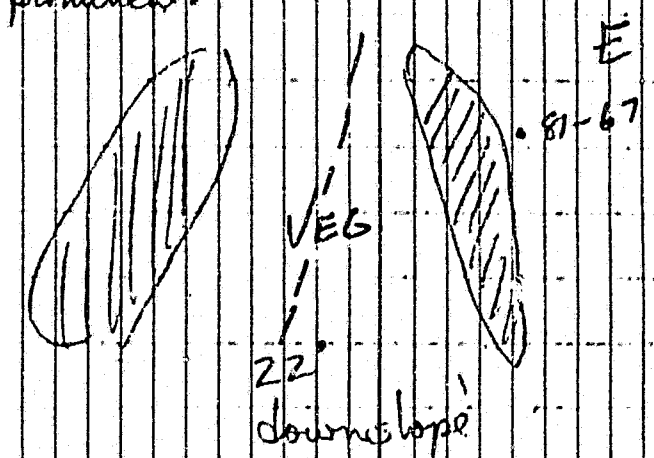
Carbonate staining - hematite (dark deep red) Bedding plane cleavage, not as prominent as the first site.

* 294° west
 * 318° west
 * 65°
 open, rough, curved.
 plane, smooth, 1-1.5' across,
 bedding plane cleavage
 quartz filling to 2"

STA A
 1549' @ 318° @ 58°
 Back up on the hill, will head
 along the stream from here, downstream

A-N	104'	273° (279°)	5° downslope
N-O	102'	76° (258°)	12° upslope
O-P	100'	258° (77°)	
P-Q	69'	302° (308°)	8° upslope

D-81-67 (Q)
 Two outcrops ~40' long and 10' high
 each. Reddish tinge, dark gray fine grained
 argillite. A few fine grained stretched
 sand grains. Hard to very hard, outcrops are
 a thin veneer of rock slightly weathered,
 competent. Doesn't appear to be graywacke,
 sandy argillite. Some bedding plane
 cleavage, but not enough exposure to see
 if it's prominent. upslope



Only a few feet above the cliff, into the (Q)
 outcrop trending 22°

Joints:
 * 56° 56° SE approximate bedding
 plane cleavage

Elev.
 1563' @ 358°

Slight shear along laminated bedding

Q-R 100' 226° (45°)

R-S

48'

348

drop 3' in elevation

D-81-68

W chute 310°

71° 58' E

bedding
plane
face

chute

chute 33°

E

Dark gray fine grained argillite.
Hard, slightly weathered at surface,
competent. No reasons seen
here for the slides.

Elev. 1473' @ 45°

Elev. at top of the cliff
1509' @ 5° @ 57°

Joints:

* * 79° 54° S plane smooth
approx bedding plane cleavage,
1/4" quartz filling, v. close 8" over.
2" - 2

* { 330° 56° NE crown plane, smooth
forms overhanging blocks, 1" to 3'
long where it's < 1' but generally

* { 338° 67° NE
quartz veins along, pink
in places not continuous
~20' spacing

Q-T

100'

348°

(342°)

6° up slope

T-U

70'

32°

(21°)

18°

D-21-51 (4)

Interap - 10' high and 25' long,
not exposed on W side of knob. Dark
gray to charcoal gray fine grained. shaly (lite)
The rock is only slightly phyllic through.

Elev. 1592 @ 57° 51' SE

vertical surface in places brings out
the laminated bedding. 4/10

horizontal joints parallel to
slopes;

* 304° 67' NE plane, smooth

* 24° 84° SE cliff face
smooth, plane 1' to 1.5'

the slight weathered competent

1545' @ 60° @ 55°
(8° difference)

TRAVERSE FROM STARTING POINT BACK
TOWARDS BH-1

AA-BB 125' 46° (42°)
7° upslope

BB-CC 84' 62° (65°)
6° upslope

CC-DD 82' 299° (295°)
2° downslope

DD-EE 91' 276° (276°)

DD-FF 91' 3.5° upslope

FF-FF 103' 272° (274°)

horizontal (85°) (83°)

FF-GG 114' 3° downslope

GG- to top of cliff face
east end of ridge 81-52; E.
61' 320° 298°
18° upslope

ELEV. TIE-IN POINT 1559 @ 043 PM @ 54°

BH-1 1433' 649 58°

TOZ - Did not see any problem areas in the rock today. Did see a few notches but the lacked any exposures so could not ascertain whether it was tightly jointed & lined, or a dike. Got the distinct impression that slabs of the rock slide past each other along the bedding plane cleavage. The whole downslope traverse was approx along the bedding plane surface. MGSILLITE showed some along the laminated bedding planes. Also some surfaces had a fibrous or scissored surface - foliation(?). Could not trace this from one laminated plane to another.

HRS. 14.5

Plotted 5-31-81

5-23-81

It's a mostly cloudy and cool morning. Henzen and I will on the right abutment just downstream of the drill sites. CRANFORD & WHITE will work on the seismic line on the left abutment and the east end of the lake on the E-NE facing cliff face.

Photos: mosaic

JBH-1 elev. 1415' @ 74° @ 56°

Traversed to 81-58

Elev 1240' @ 75° @ 56°

Will begin our tape & Brunton traverse from here. Traversing down the d/s side of the buttress

A-B 41' 277° (277°)
13° downslope

R-C 90' 238° (62°)
47° down-slope

C-L 25' 87°

D-81 (2) outcrop, tie in
is its down-slope east corner. It is
5' high and ~60' across. The
outcrop consists of the medium to dark gray-
fine grained argillite. Hard, outcrop face is
slightly to moderately weathered, competent.
Dip-sloping is close to moderate close.
to bedding plane. Average
Elev. 1180' @ 9° @ 58°

Joint 5:

238° 72° N plane, smooth

45° 27° SE curved, rough

50° 36° SE 6"-3" aver. 1.5'

79° 14° S plane smooth

238° 55° NE plane, smooth

2' aver. 1'

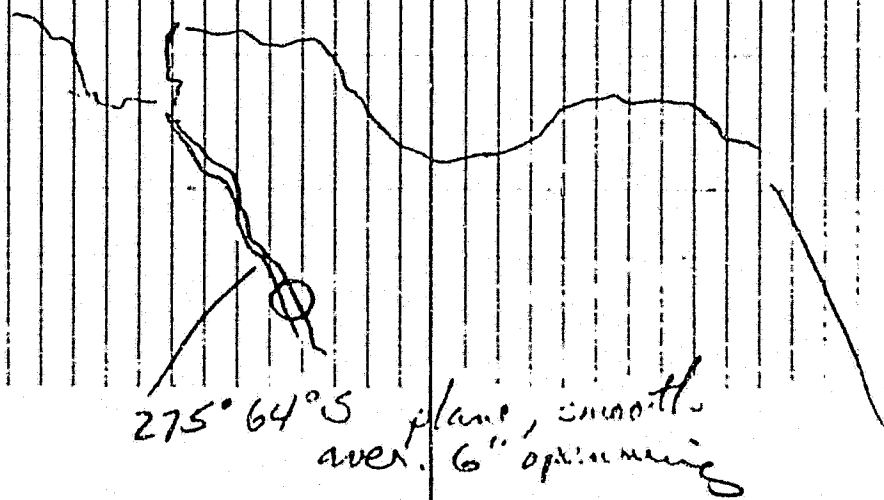
37° 44° SE plane, smooth 1" to 2"
aver. 8"

C-E 85' 172° (355°)
31° down-slope
34° up-slope

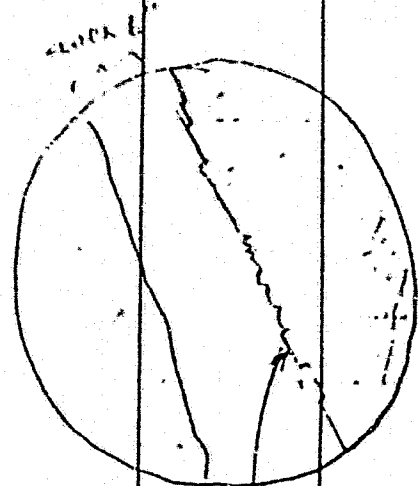
D-81 + 71 (E)

Side of the outcrop which is very
prominent and is the west facing cliff
face that goes way up-slope. We are
looking at the west facing face ~40'±
high. Dark gray fine grained argillite.
Hard, competent, face is slightly weathered.
Large open joint, block may have slid down.

Elev. 1153' @ 9° @ 58°



The large open crack has very smooth
part like faces



Minor due to sliding, smooth surface
no chisel, no joint visible but could
have been washed out of minor. No
distinct appearance on weathered surface

Joint
Major* 345° 75° NE plane, smooth
2" to 2' over 1'
c. 56° 37° W? plane, rough
over 4' spacing; 8" to 6'

66° 51° NW plane, smooth
4" to 2'; over 1.5'
- above altimeter reading 40'

- at altimeter reading
312° 34° SW plane, irregular
quartz fillings to 4", plane-
curved, smooth 8" to 2'
over 1'

Major { 287° 71° S } plane, smooth, 4"-2"
90° 72° S } over 1'

> 290° 11° S

345° 76° NE plane, smooth
over 1'

E' 75' from C same bearing

E' - F 90° 202° (31°)
41° downslope

F - G 85° (284°) (287°)
14° upslope

rock buttress begins @ 35'

(G) tagged nearby STA G
 in a block that cuts across the
 bed. I approximately 200'
 80'-100' high. One tie in
 station is 50' from the 1/2 end.
 The rock consists of fine grained argillite and over-
 lying the outcrop face the rock is a
 dark gray to charcoal gray very slightly
 foliated rock, only slight seen in places.
 Outcrop is hard, competent, surface is
 mostly weathered?

Loc. 1104' @ 11³³ @

Joint measurements ~ 100' ^{1/2} of
 tie in point.

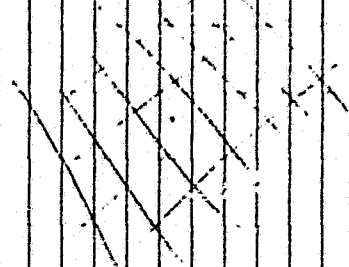
Joints:

- 19° 84° E plane smooth.
 2" to 3'; 4" ?
 318° 66° NE plane, smooth
 2" to 1.5'
 * 63° 21° NW plane, smooth
 3' to 5', aver. 4'

- * { 79° 70° N plane, smooth
 aver. 1.5' 4" to 3'
 * { 337° 76° NE plane, smooth
 aver. 1.5' 4" to 3'
 70° 84° S - open joint, 4",
 detached block from rest of
 outcrop 3" to 3' aver. 1'

Two joint sets come together here,
 very closely jointed, argillite is banded,
 sampled. On one set it has a laminated
 appearance, no set pattern, all different
 dips. ^{for laminated appearance} Zone is 4' wide. Hit rock
 face sounds hollow, jointing produces
 exfoliation, slabs

336° 80° E defines the 1/2
 contact of this banded argillite



Appears

Two
 * 321° vert. plane, smooth
 * 342° 64° NE
 * 354° 73° NE
 * 281° 66° N curved, smooth
 * 271° 64° N has the laminated
 * 275° 67° N appearance
 Thin whitish lam ~ horizontal
 cracks into this zone:
 314° 15° SW

Joint at G
 342° 72° NE plane, smooth
 6" to 2' ave, 6"
 54° 64° NW plane, smooth
 spacing is wide, cliff face
 is subparallel to difficult
 to go spacing
 282° 9° S curved, smooth
 ave 5'

G-H 36' 268° direction
 20° 87° 88°
 downslope

G 1104' 12.12 @ 81°

H-I 98' 166° direction
 346° ()
 37° upslope
 downslope

I 1037' @ 12.53 @ 65°
 bottom of chute before dropping
 straight down to the river old rope
 here, ladder below

D-81-73 (J)

I-J On the river

~60' BELOW I (REACHED EN RAPPEL) - RIVER LEVEL

- EXTENDS UPSTREAM ~100' (BEARING 119° → UPSTREAM EDGE)

- WORKING DOWNSTREAM (TOTAL STATION 150')

(Q-10) STEEP SHAPE RAILLITIL LT GREY ARGILLITE

JOINTED 350°/VERT. 5"-1' AVE 6"

(10-85) MASSIVE CLIFF

JOINTING - BEDDING 455°/61° SE 6"-2' AVE 15'

* 153/32° SW 5'-2' AVE 1' Quartz fillings

* 212/72° NW 3'-1.5' AVE 8"

(85-120) PROMINENT OPEN (→) FACES & JOINTS - 238°/VERT. 40°/2

CONT.

J (cont) AT RIVER LEVEL OLD DRILLSITE
IRREGULAR QZ. FILLINGS → 1.5 DIAMETER

All joints are piece and smooth

View from cliff

~ 200' d/s bedding to approx

~ 278° and dip 66°S

Large quartz fillings visible

Return to G

1155' at 2³³ @ 65°

G to K 100' * 100° (286°)
3° downslope

K to L 75' 83° (77°)
14° upslope

L to M 80' 110°
~ 25° downslope

D 81-74 (M)

In a chert, good rock exposures
either side ~ 125'-150' above the river
Some dike material exposed on the 319°
face, assume dike is coincidental with
the chert, would be up to 8' across.

Dike orientation

319 79° SW

Elck. 1126' @ 3¹⁰ @ 63°

Joints

{ 47° 74° NW plane, smooth
1" to 8" aver. 4"
- 16° 39° E plane smooth,
aver. 1" 4" to 15"

Felsic

Dike is a white to light gray stalling
rock, fine grained. Quarzitic to apilitic(?)
sampled. No rock exposed in the chert
except further downslope. Dark gray
fine grained argillite is exposed on
either side.

Can see a fracturing zone on the
SW facing cliff face ~ 20', small
intermittent fractures 3" spacing.

to N

90'

* 11°

(187°)

33°

upslope

32°

downslope

- 75 (N)

Outcrop is stepped.

Outcrop is ~ 170' across

Rock ranges from a white gray - light gray to dark gray, very fine to fine grained rock with generally square quartz eyes up to $\frac{1}{16}$ ", medium grained. Also there are small angular

Elev. 1220' @ 3° @

tie in is to the middle of the outcrop.

1240' @ 6° @ 63°

to rounded clasts of an argillite/phyllite, generally $\frac{1}{8}$ " - $\frac{1}{4}$ ". Appears that the rock has been baked, as it is very hard, and cooled quickly, resulting in numerous small fractures parallel to the major joints. Upon metamorphism, veins filled the white cavities = quartz eyes and the argillite → quartzite. Zones of argillite (dark gray) with quartz eyes

Joints:

@ 40' from chute on up

4° 67° N, large open joint (353°)
approx. aver. 5" plane-curved
smooth

272° 77° N plane, smooth

1" - 4" in a zone, but generally
1" to 4"

Major * 72° 10° S plane smooth
82° 14° S

in tightly jointed zone or shear
1" to 6" aver. 3"

regular

6" to 3' aver. 1.5'

Major * 345° 85° W plane, smooth
341° 83° NE 2" to 2'

aver. 3" - 6"

Major * 79° 84° N cliff face rough
plane-curved,
1" to 1"

- lots of fractures associated with the
major sets

355° 85° from clastic in 1/2" ...
 85° 74° N plane, smooth
 3" to 2' area ~ 8"
 227° 20° S tightly jointed, ...
 ... no gang visible
 up to 3" thick, spacing
 1/8" to 1"; irregularity
 6" to 2' area ~ 8" - 10"

seen in the light to medium gray
 metabitic rock, but are not clasts/rock
 fragments. Samples...

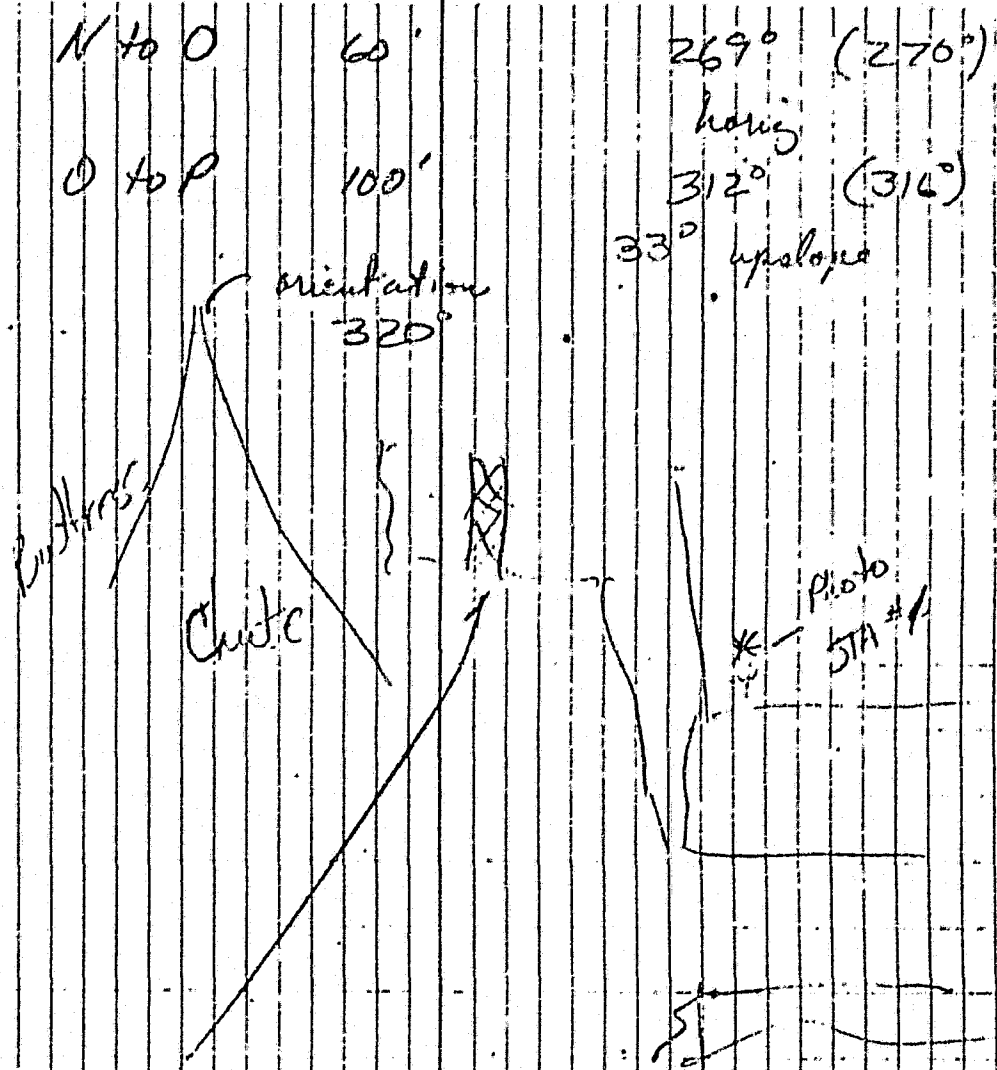
Will check the lower bench

in an argillaceous matrix

Mostly a reddish dark gray, fine grained

little gray rock with clasts of white quartz, dark
 fine grained phyllite (only slightly phyllitic),
 and some gray argillite! At the east

the "lower" exposure, have the
 paragneiss and the associated
 structure, from being quickly cooled



like appearance 335° to 76° NE 3' 4' wide
 to the white gray to medium gray fine
 grained rock. Aplitic to granitic. Quartz
 eyes.

H-A (8-58) 65'

354° (18.2°)

52° upslope

52° downslope

A (81-58)

1347° @ 63° @ 42°

Top of ch. te for first day 5-20-81
STA D

1453' @ 858 @ 62°
est. slope of 35° 40°

1453
- 123
1330'

E.H-1

1538' @ 654 @ 58°

TOD - What appears to be dike material, might not be. This material is a white gray, light gray, or medium gray; fine grained rock with quartz eyes. This is in close association with argillite that contains the smoky quartz eyes. It seems that the "dike" material may be just more quartzites. Also these zones are highly fractured, maybe due to being quickly cooled. Difficult

to determine what the boundaries are and their trend. Have seen zones of argillite in this material, at these locations it appears to be a color change only, no sharp boundaries.

HRS

12

field

2

office

Plotted 5-31-81

5-24-81

It's a mostly sunny day, little hazy.
 morning and I will work on the right.abutment
 some more. I will work on the left abutment at the east facing
 cliff east of the lake.

13H-1 1415' @ 72° = 5' 52°

4-81-75

Returned to check a few things. If
 the "dike" is 25' wide and
 trends 70°. Approx contact is an open
 joint oriented 72° open up to 3"
 irregular, rough, 1' wide fractured
 rock. This was best estimation of the
 trend at this time. Lithic gneiss
 exposed up slope, reddish dark gray,
 fine grained matrix with small white
 quartz and dark gray to charcoal gray, very
 fine grained argillite/phyllite.

Followed the trend of the "dike" to the
 buttress area to the west, walked up and
 down slope along but could not see any
 of the "dike" material. Find the reddish
 dark gray fine grained argillite with
 lots of quartz veins and pods within. In
 places the white quartz is found along
 bedding but in others it cross cuts. The real
 thin veins < 1/2" are generally highly contrasted.
 Some phyllite layers, thin, low schistosity
 are intercalated with. Thinly laminated
 bedding shows up well on weathered outcrop
 face.

285° 390 S, discontinuous
 quartz filling up to 1.5' thick
 and 3' long

D-81-76

Between 81-58 and the saddle at the top
 of the buttress the "dike" material is
 exposed. It's the white gray fine grained
 rock with quartz eyes. As it grades to
 the lithic graywacke it changes to

the medium, gray fine grained quartzite.
rocks with quartz eyes.

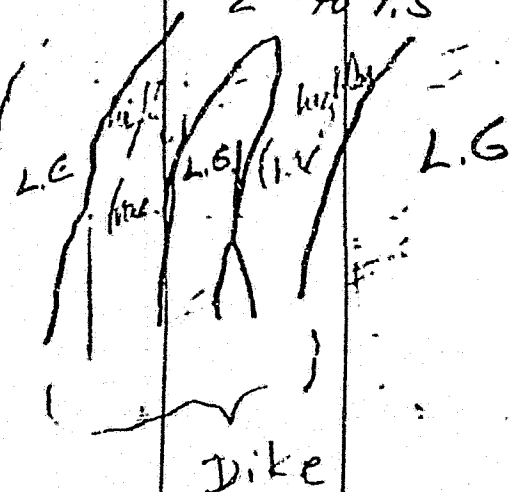
It has approximately 7' wide wavy contact
which has an approximate trend of
322° 77° SW

514

"Dike" is oxide stained to an orange or
deep orange-red (rust) color with the weathered
white-gray joints in "dike" locally highly fractured
359° 85° W plane, smooth
1/2" to 8"

45° 19° SE plane, smooth
2" to 1.5"

Cliff face
goes all
the way
up slope



83° 72° N plane, smooth
to rough 4" to 6"

D-81-75

1150' @ 923 @ 64°

Just below the place in the chute
@ 1105' @ 950 @ 65°
~ 15' below our bottom most
STA on 5- - 81

D-81-77 Mafic

Approx 30' below @ Dike
material exposed in the chute. It's a dark
gray fine grained rock; sugary texture. Possibly
a mafic dike. Weathered surface is
a earthy red brown color, looks baked.
It is ~ 7' wide. Trend of the dike
is somewhere between:

317° 83° NE

338° 83° NE

The dark gray very fine grained argillite
on either side is highly jointed.
Estimate spacing at 1/2" - 4". The dike
is slightly to moderately fractured,

med. to hard & competent: Overal
dike zone is competent

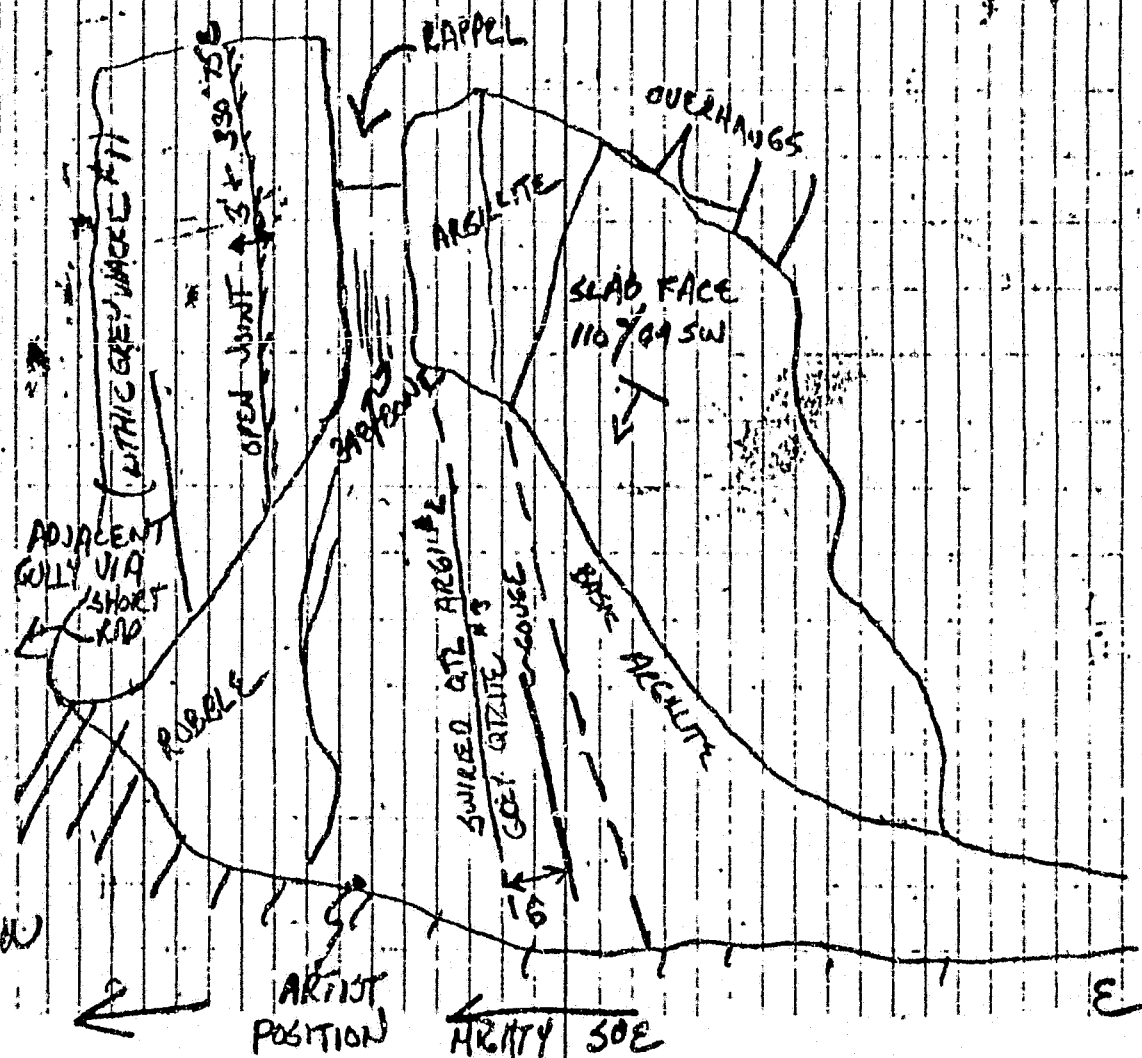
Joints:

318° 77° NE plane - curved
322° 6° NE 1" to 6"
9° 12° E 3" to 1"
plane smooth

It is jointed, joints are 6" - 1.5' wide
Not of the "Sil." white gray to red
grey color of quartz, eyes is seen in thin
chert

Continuation of dike:
347° 81° E trend of dike
~ 15' below @
- argillite is slightly phyllosilicate here
one has transitioned to 1" to 2"
not bad here

D-81-78 @ RIVER LEVEL ~ 190' RAPPEL
TRAVERSE ALONG RIVER EDGE @ LOW WATER ~ 100'
UPSTREAM - JOINTS IN WATER-POLISHED ARGILLITE
- 197°-VERT AVE 3' R- 1'-5' ^{SMOOTH} PLANE
MAJOR - 346-80° NE SMOOTH PLANE
AVE 1.5' R 2'-3' (CLOSE LOCALLY)
59-18° SE SMOOTH PLANE AVE 1.5' R 6'-5'
185-80° W " " AVE ~ 4'+
324-VERT " " AVE ~ 3'+



D.C. CONT.

LITHIC GREYWACKE - WEST GULLY CLIFF - FORMER

SAMPLE #1 - PRAIRIE IN OUTCROP. QZ PEPPERS

FILLINGS 3" TO 4"

- JOINTING 342/80°E S. PLANE AVE 2' R 2'-6'

45/66 NW " " AVE 5' R 6'-8'

- CENTER OF GULLY

W ← → E

BRIGHT / GRAY

GULGE ALONG 325°/80°NE TREND ~ 3" WIDE GRASSY / ARG

TIGHTLY FRACTURED ZONE ~ 4' WIDE

- brecciated, sand to clay

RAPID GULLY JOINTING AVE 4" SPACING 518/80°NE

Sampled rocks (3)

- Shear zone had gouge, associated with dike. Quartzite (med gray) butts up against the gouge.

S. p. 1 taken adjacent to the dike in the argillite, some is a medium gray quartzitic material, argillite banded due to thermal metamorphism.

arg. grad. quartzite dike
 ← at least 11 ft. temp.
 arg.

Spur below brace in the chute
 1130' @ 293 @ 69°

Ridge adjacent to the chute (west side) and east of the long outcrop of 'dike' material is of white-gray with quartz eyes and some medium gray quartzitic material. Some argillite layers are interfingered with.

Trend of ridge material is approx.
 323° 86° SW

Open joint (81-75) narrows to 10" ~ 200' up & ends
 D-81-58

1304' @ 393 @ 72°

BH-2 1290 @ 317 @ 70°
 actual is 1214'

DEI-19 @ RIVER OPPOSITE left abutment TALUS cone
 is ... down the large chute between
 EH-2 and BH-5. The chute is
 vegetated at the top and is covered at
 the bottom. Dark gray, fine grained argillite
 with very fine sand particles. Hard,
 highly fractured. Highly fractured zone
 trends ~342° - 346° is ~15'-18' wide,
 this fracture zone doesn't correspond
 with the trend of the chute. Lots of
 discontinuous highly contorted quartz stringers
 Joints:

	347°	83° NE plane, smooth
*	112°	80° NE 1/2" to 1'
	→	area 3" in this highly fractured zone
6"-8" ...	65°	16° NW plane smooth
		1' to, wide to very wide
	74°	72° SE bedding plane cleavage
	70°	poor joint along ~1"
		67° SE bedding, 6"-2'
		area 1'-1.5'

Stratification in the argillite, dark &
 laminated bedding
 graywacke (sandy argillite, fine gr.
 sand). Bedding plane cleavage

is moderately prominent

347° 76° NE 3" to 4', area 1.5'
 away from fracture zone - 0/5
 15° 60° NW plane, smooth
 area 1'-2'

Orientation of the chute and mafic dike
 0° west

Estimated width 3' to 4'. Lined up with
 the notch above the scree slope on the left
 abutment. Mafic dike is a dark gray to
 black very fine and fine grained rock. Contains
 fine grained clear quartz crystals, cubic.
 Dull medium brown color, mottled.

Sampled.

Rock is generally good except it is
 highly jointed and the dike is not as
 resistant as the argillite. Should check
 its vec. Dike is not well exposed, don't
 know if the fracture zone occurs in the
 dike material all the way along. It
 is highly jointed 2"-3" at river level,
 but higher up it would be out of
 the ~342° highly fractured zone.
 Contact is sharp

5-21-81

1042' @ 5³⁸ @ 66°

TOD - Returned to 81-75. There were no signs of the 'dike' material in the chute to the east or the buttress to the west. Therefore no trend was determined for the 'dike' material. So maybe it is the bedding of the argillite, but why??

Saw dike material in the two chutes which we rappelled down. It was a mafic dike generally highly fractured zones associated with. Both are adjacent to the centerline. May have Horn? HEINZEN return to 81-78 to do 100 joint measurements. Dropped my brumton today bent the hinge. Almost stepped on a ^{jumped} porcupine today at 81-75, just about to jump when I saw him.

Plotted 5-31-81

HRS.

11.5

Field

office

5-24-81

It's a beautiful clear sunny day. It got cloudy as the went on. B. Holm arrived in camp in the A.M. I worked on the mosaics in the morning. Also discussed the project & climbing/mapping methods at Devil Canyon. Gave Byrne a quick course & fly around of Devil Canyon. Heinzen & Holm began climbing down at 2³⁰. They are working on the left abutment and they ascended down the scree slope.

Byrne & Jim rolled a wheel on the scree slope down into the SUSITNA. It should be in TKA tomorrow morning.

Scree slope revealed mafic dike material

D-81-80

in river at $\frac{1}{2}$ edge of talus slope,
approx C/L

D-81-82 ~ 40' upslope and maybe 15'
 $\frac{1}{2}$ of the last site

D-81-81

Quartz fillings ~ 4" wide,
numerous adjacent to the potential

Dike ~ 200' upslope on the $\frac{1}{2}$ side
Rock is purplish sandy argillite to phyllite
67° 51° SE bedding plane

cleavage

overhanging; quartz stringers are
contacted generally subparallel
to bedding up to 4". Shattered
appearance

, slight sheen. Well indurated. Competent
No regular pattern to the jointing.

Sampled

Open joint

166° 70° W plane - curve,
smooth, 1' wide
extends $\frac{1}{2}$ ~ 30'

Highly fractured zone adjacent to open joint
162° west 1" spacing, 6' wide

Joints: ~ 20' $\frac{1}{2}$ s, horiz. of open joint
0° 76° W 3' to 1.5', aver. 1'

smooth plane

302° 75° NE, smooth, plane aver. 3'

320° vert.

34° 65° SE plane, smooth to
rough, aver. 4", open to 3".

Rock adjacent to has undergone contact
metamorphism, see samples

D-80-83

D-80-84 Approx 150' $\frac{1}{2}$ s adjacent
to scree slope on $\frac{1}{2}$ s side. Outcrop
face looks like it is oriented ~ 320°

Heinzen & Holm ascended back up the slope
at 5³⁰ to 6⁰⁰

TOD - Both climbers need radios. When
they are separated they can't talk to one
another. Dikes & highly jointed zones are
showing up real well on the left abutment.

HRS. 12

5-26-81

It's a beautiful clear, sunny day.
McKinley looks fantastic. Bjarnes, Jim, and I
will work our way down the same slope on the
left abutment at Devil Canyon.

R₂M Vert E11 DA, 1980
1410' @ 7° @ 59°

White & Crawford are working at
Watson on the right abutment.

J 11 85

Outcrop ~ 20' above the river. It is
a wide gray to charcoal gray fine grained
rock. argillite to phyllitic argillite. Rock
is hard, competent, outcrop face is only
slightly weathered.

JOINTS: 350°
Major * { 346° 85° E 4" to 25' over 1-1.5'
 { 354° 81° E plane, smooth
 290° 11° plane rough

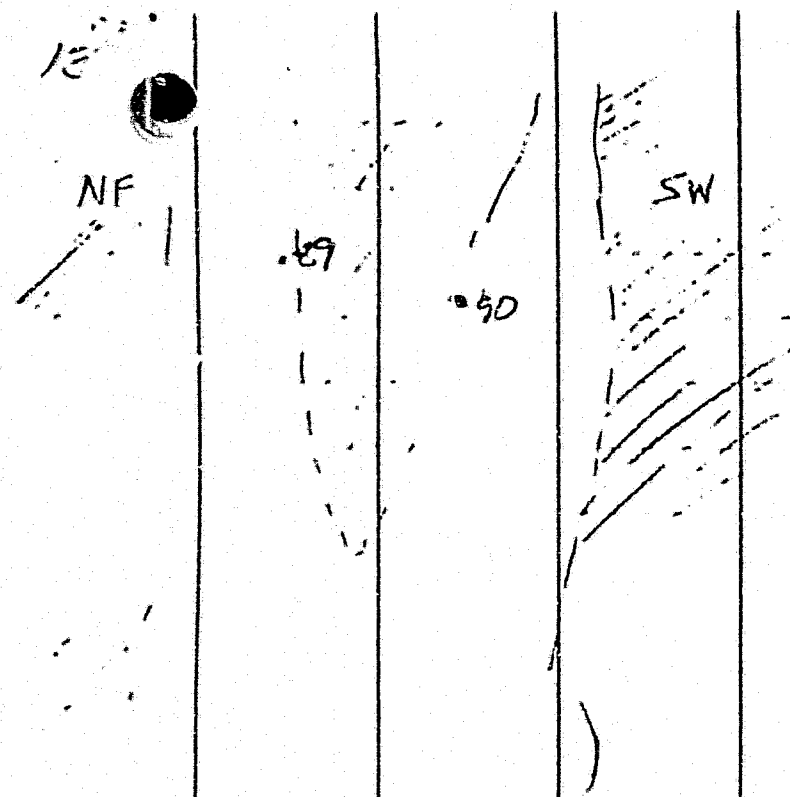
50° 47° SE may approx: bedding
looks like small mudcracks
not prominent here; plane
smooth

Major * { 345° 18° SW plane, smooth
 293° 11° S 8' to 4' over est.
 somewhere between 1' & 2'

D-81-89

Climbing up this chute to 1148' @
1025'. Have two grained sandy argillite and
the phyllitic argillite exposed up this chute
which trends an estimated 344°. Something
must pass through here, either a dike,
highly jointed zone or shear. The rock on
either side is very hard-hard, competent,
slightly weathered. Will have to have
someone check it out higher.

324° 88° NE plane rough
one face of chute



1 81-90

Dark gray, with small fine grained (very small) sand grains, argillite. Nothing exposed in this chert except possibly higher up.
Joints

- | | | |
|------|--------|---------------|
| 336° | 81° NE | plane, smooth |
| 349° | 86° NE | |
| 56° | 72° SE | plane, rough |
| 80° | 45° S | |
| 340° | 55° NE | area, 1'-2' |

Jim and Tim have circled around & are p higher in the chert. This station is approximately the same height as 81-87

Byron and Tim are $\geq 50'$ above where I left off

Photos:

- 1 Me rappelling down scree slope
- 2 STA 81-79, dikes, fracture zone
- 3 Prominent subhorizontal joint near river level on right abutment at $\frac{1}{4}$, 100' to 300' long
- 4 $\frac{1}{4}$ rapids, low flow, $\frac{1}{25}$ sec
- 5 " " $\frac{1}{60}$ sec.

River level

1005' @ 120 @ 70°

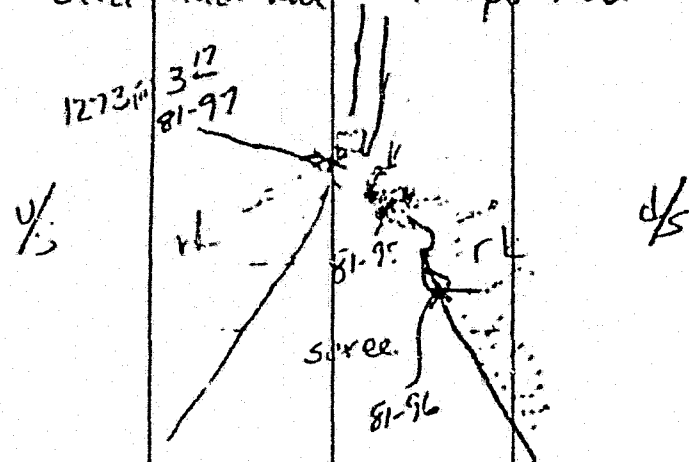
D-81-95

Rock outcrops on the $\frac{1}{4}$ s side of the scree slope and on the $\frac{1}{4}$ s half of the chert.

Elev. 1179' @ 140 @ 70°

The rock is primarily the dark gray to charcoal gray, very fine grained phyllitic argillite. Light seen along parting planes. There is some dark gray argillite with fine

grained sandy granites. The rock is hard,
slightly weathered on outcrop face, and
compact. Well developed foliation
exists, no apparent weakness along. No
Siliceous material outcrops here



Major	346°	vert.	plane-smooth	
	322°	77° NE	plane-curved,	rough;
	322°	76° NE	face	
Minor	58°	61° SE	plane, smooth	bedding
		thinly laminated		
	57°	67° SE		
	50°	81° SE		
secondary	347°	22° W	plane, smooth	

Difficult to determine joint spacing because
of the vegetation cover

Elw. 1193' @ 2³/₄ @ 70°

D-81-96

Medium to dark gray fine grained
argillite. Rock is hard,
weathered, and competent. Overall joint

Elev. 1165' @ 23° @ 73
spacing is moderate. close to wide.

Joints:

Major 286° 53° N plane, smooth to rough
341° 86° NE plane, smooth
+ 1' locally
284° 86° S curved, smooth to rough
Major 68° 68° SE, plane, rough, approxi-
mately bedding plane, 18"
locally

returned to 81-95; 1195' @ 3⁰¹

D-81-97

Characteristics jointing revealed on this NW facing slope

Major { 335° 72° NE plane, smooth
339° 75° NE

spacing 2" to 2' aver. 8" 10"
 (1) the down to charcoal gray
 fine grained phyllitic argillite
 - Highly jointed & fracture zone - 30'

296° 30° S plane, smooth
 6" to 1.5' aver. 10"
 342° 16° SW

On the opposite face, NE facing

80° 47° S plane, smooth
 317° 54° SW

In traversing across the scattered outcrops in the chute, no dike was found, all the rock is the phyllitic argillite. In this whole area of the scree slope, no prominent bedding plane cleavage exists. Because of our exposure, the NW set was most seen.

330° 70° NE plane, smooth
 ~ 3' wide fracture zone
 1/2" to 2"

Elev. 1475' @ 600

Camp.
 2344' @ 640

Coming back up the scree slope/chute in the upper section found several highly jointed zones which trend NW. Also there is an abrupt change in the dip of the bedding in a very short distance stratigraphically (on the order of ± 35 feet), from $\sim 50^\circ$ to 20° . This is a very pronounced feature. At the top of the chute, a dike and shear zone are exposed. All notes for these stations and the dikes adjacent to the scree slope are in Byrne Holm's notebook.
 Photo's: #6 & #7 of dike & shear zone

14
TOL - Have been able to pick out
the dikes generally, prior to getting
to the associated chute. Have shearing
associated with some of these dikes,
along C/L. The dikes are only
moderately competent, less resistant.
Had an abrupt change in the dip of
the bedding. To date, we haven't seen
this in any of the adjacent area. Check
this out when the climbers work further
W/S.

143
27.
5-~~26~~-81
It's cloudy and there is a light
drizzle this morning. The three of
us are working in Devil Canyon on the
north abutment.

Rappel down to river level at 81-78.
Will work d/s on ropes.

Photos: looking W/S at C/L #8
#9 dike visited by Byrne
& Jim yesterday

D-81-78

Dark gray fine grained argillite
small dike visible with a orange zone
along the W/S contact. The argillite
shot through with quartz. adjacent to
the zone is a orange
-tan and blue gray brecciated clay

are up to seven inches across
 bed 335° 85° NE
 strike of shear zone $\approx 10, 11$

Strike on d/s side of shear zone
 * 323° 60° NE primary { plane smooth
 358° 7° S } area 4"

Below the d/s side of the shear zone is
 a medium to dark gray porphyritic rock.
 It is numerous with plagioclase phenocrysts
 in a quartzitic texture.

The dike is exposed in 60' above the
 river. It is dark gray, fine grained
 gabbroic dike. CI $\approx 50-60\%$. Weathered
 surface has the characteristic dull,
 earthy, medium purplish-brown. Sampled
 11-12, outcrop face is moderately weathered.
 The dike is approx. 75' wide. Sharp contact.
 The base has 336° 75° SW
 Amphibole is the medium to dark gray
 quartzitic rock.

* Dike is highly jointed & fractures
 continuation of dike seen at 81-77

Sampling the dike,
 327° 75° SW $2"$ to $1'$
 70° 85° SE $3"$ to $5"$
 304° 13° NE $4"$ - $10"$

On the d/s side of the dike the rock
 is the little gray marble or conglomerate
 (Photo # 12). Rock fragments or clasts
 reach 5" in diameter. At this outcrop the
 clasts comprise $\geq 50\%$ of the rock.
 There is an interbedded situation of a gray marble
 to medium gray porphyritic rock.

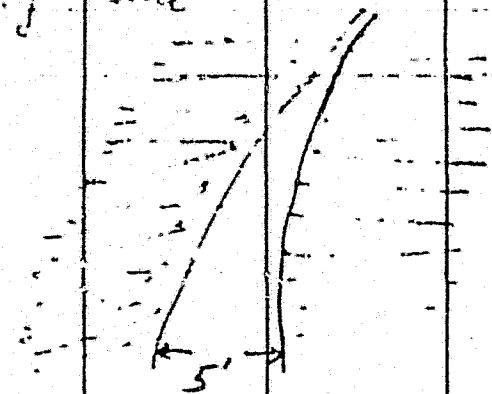
Dike is not exposed at river level and
 doesn't appear to match up on the opposite
 side (Photo # 13).

In the area of the dike & shear
 zone, have weak zones. The amphibole,
 porphyritic quartzite and the little gray marble/
 conglomerate is blocky, hard, competent.

Site is probably the first hole d/s
 of the talus cone on the right abutment.

30° 78° E plane, smooth
 62° 70° NW plane, rough
 54° 16° SE plane, rough
 since joint is wide

joint on $\frac{1}{5}$ side
 of dike



Highly jointed in the outcrop on either side

151° 80° NE plane, smooth
 1" to 5" adjacent to cavity
 1" of open cavity

Photo #14 of dike

Finished this chute, moved to BH-2 where Bjorne & Jim are going down the chute adjacent the borehole on the $\frac{1}{5}$ side.

D-81-122

Bjorne & Jim are at the bottom of the chute mafic dike is exposed at river level. Believes it matches up with the mafic dike adjacent to the scree slope, $\frac{1}{5}$ side, on the left abutment.

D-81-123

Station on $\frac{1}{5}$ side of main chute just above where the branch comes in from upstream, ~ 80' above the river or $\frac{4}{5}$ the way down from BH-2.

D-81-124

~ 250' up the slope or half way between river level and BH-2, $\frac{1}{5}$ side of chute

11 125
 river level. dices is ~ 25' d/s
 7' wide

TD-running discussions of geology at Devil
 Canyon with emphasis on dices. Several
 of the dices appear to match up, on either
 side of the river.
 1.5 hrs field
 1.5 hrs office

- 145
- SAMPLES:
- DEVIL CANYON
- WINTER MAPPING
- D-81-41
- SUMMER MAPPING
- D-81-54
- D-81-61
- D-81-72
- D-81-74
- D-81-75
- D-81-78
- D-81-79
- D-81-81
- D-81-78

AAI BOOK 18

SUSITNA HYDROELECTRIC PROJECT

DAMSITE SURVEY POINTS

	<u>Northing</u>	<u>Easting</u>	<u>El.</u>
DP-1 (WW-3)	3,227,267.364	742,387.705	1457.4
DP-2	3,227,342.558	742,320.822	1531.7
DP-3	3,227,261.895	742,853.724	1521.3
DP-4	3,227,222.168	743,195.00	1552.95
DP-5	3,227,121.010	743,551.935	1562.97
DP-6	3,227,285.432	743,626.784	1653.4
DP-7	3,227,457.663	743,143.084	1698.8
Dp-8	3,227,513.066	742,756.762	1720.2
"KNOB"	3,228,222.661	748,072.926	1695.2
LASC-1	3,226,359.24	746,050.155	1868.2
LASC-2A	3,225,978.719	743,992.675	1832.50
LASC-3	3,226,492.379	743,047.503	1728.9
MAC	3,228,156.451	747,370.936	1467.9
RASC-1	3,226,987.175	744,693.169	1645.1
UP-1	3,227,962.871	746,680.081	1694.8
UP-2	3,228,129.820	746,909.684	1672.97
UP-3	3,228,024.922	747,012.184	1544.76
UP-4	3,227,854.407	746,872.811	1535.16
UP-5	3,228,250.578	747,025.081	1513.7

W-4 N 3,228,000

79
57

ΔWJ-7

TPR-8

"THE FINS"
AREA OF MAJOR
SHEARS AND
ALTERATION ZONES

345/85E

WJ-8

187S

N 3,229,000

REFERENCE: BASE MAP FROM COE, 1978 - 1" = 200' WATANA TOPOGRAPHY, SHEET
COORDINATES IN FEET, ALASKA STATE PLANE (ZONE 4)

Notes from Field

alteration zone / shear

alteration zone / shear

alteration zone / shear

alteration zone / shear

alteration zone / shear

Photo
K82-2

31.32 + 33

alteration zone / shear

alteration zone / shear

alteration zone / shear

alteration zone / shear

alteration zone / shear

alteration zone / shear

alteration zone / shear

alteration zone / shear

alteration zone / shear

alteration zone / shear

alteration zone / shear

alteration zone / shear

alteration zone / shear

alteration zone / shear

alteration zone / shear

CONTENTS:LAYOUT:

BOREHOLES	1-5; 13
SEISMIC LINES	7-12, 14-29, 32-3
CONTROL POINTS	29-32, 38-40

SURFICIAL MAPPING:

DEADMAN	43-109
TSUSENA	136-152
SUSITNA	109-115; 117-136

STA NUMBERS:

W82-1 through 70

7-9-82

Partly sunny day. Will start
laying out the first eight auger
holes, AH-A through AH-H.

WATANA 2260' @ 7⁰⁰
56°

SL-81-17 south end. Come
back to the shot hole with
a shovel & hand auger. Couple
of 4'-6' boulders on the surface.
Line is not flagged.

AH-E 2245' @ 8⁴⁵

- is on SW-3
- near where SL-17 almost
intersects SW-3
- to AH-D8; 30° 521'

AH

AH-D8 - st temp. probe only
Square top. 50.3°

AH-D9 - seems to be a good
distance from AH-D8
3/4" I.D.
1" I.D.
- seismic line just ~100' to west

SW-4A south end #RLS 551
shot hole.

Elev. 2267' 11⁰⁵

- something is wrong w/ SW-3
and how it fits.

- put AH-A here w/i 50'
of SW-4A

- nears tree's and brush
clearing

- SW-3 may have a
bend or turning point
in it.

- TP-20 ~125' @ 215°
from SW-4A

AP-3 shot hole adjacent to.
return w/ shovel & auger

AH-D ~ 80' from AH-D3
- some boulders exposed at the
surface, may have problems getting
down through
- 340° from AH-D3, 79'
- no problems here, no need for
clearing.
- 2332' @ 12¹⁰

AH-D11

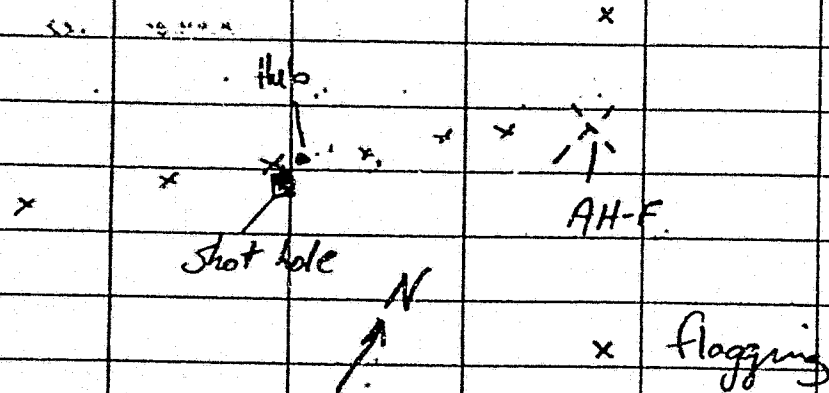
3/4" I.D.	slanted	Temp Probe?
1" I.D.	square	standpipe pipe

AH-B 2321' @ 2³⁰
248° from DR-27 & 106'
- no clearing/brushing is necessary
- flat open area. A couple of
2' diam boulders crop out
at surface w/i 100'

AH-F 2298' @ 340

- no hub here. SL not brushed
- difficult to find the turning point. Figure that the hole is close enough.
- site needs to be brushed scrub brush

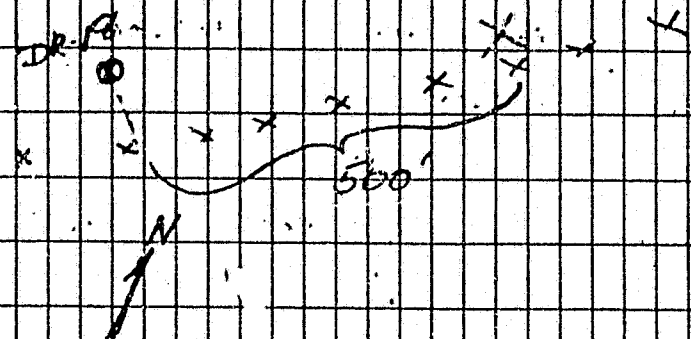
- found hub. Hub to AH-F
47° 180'



Hub says end of 80-2 ext.
(ie. 81-14) check to see if
it goes to the lake?

AH-G 2190' @ 442

- site is approx 500' from
DR-18 along SL-80-2



- scrub brush, need to
clear (4' high)

2298' @ 55° @ 55°

(6)

TOM BUSEK - DENALI DRILLING
IS IN CAMP

Need to coordinate for tomorrow with
with the following people, for:

George Smith - archeology clearance

Tom Calkin - brushing

Tom Busek - water sources for
and sites to put rigs.

- start brushing AH-A

- put rigs @ AH-A & AH-B

① Revisit all seismic lines during the
ACRES PROGRAM to identify and sample
the soils exposed in the shot holes.

② Several boulder patches on horizontal
slopes. What is the cause of the
boulder fields / fieldsomes?

7-10-82

It's cloudy today. Will get the six
boreholes cleared archeology. After will
locate more boreholes and seismic lines.

- all 6 sites were cleared by

George Smith & Jim Dixon

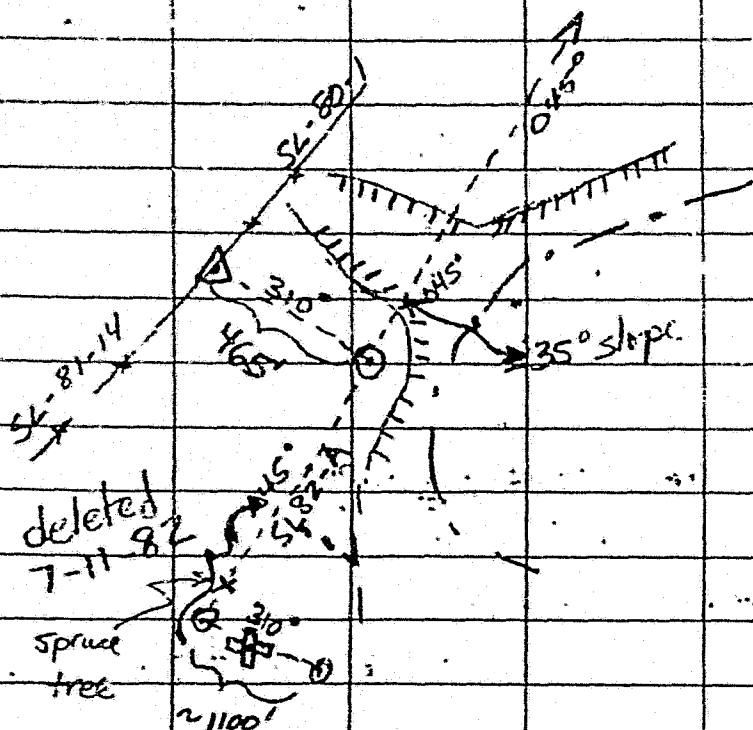
- T. Calkin & Page are brushing
AH-A

- drill rig will set-up on AH-B

WATANA

2260' @ 12° @ 58°

LAYOUT OF SL-82A



Q 2010' Q 240

+ 1980 Panel Marker

- had to move/shift SL82-A to the southeast (only the southern segment). Otherwise the line would have intersected the cliff face in places. As a compromise a segment of line was run at 310° towards Tussock Creek in order to tie into bitrock.

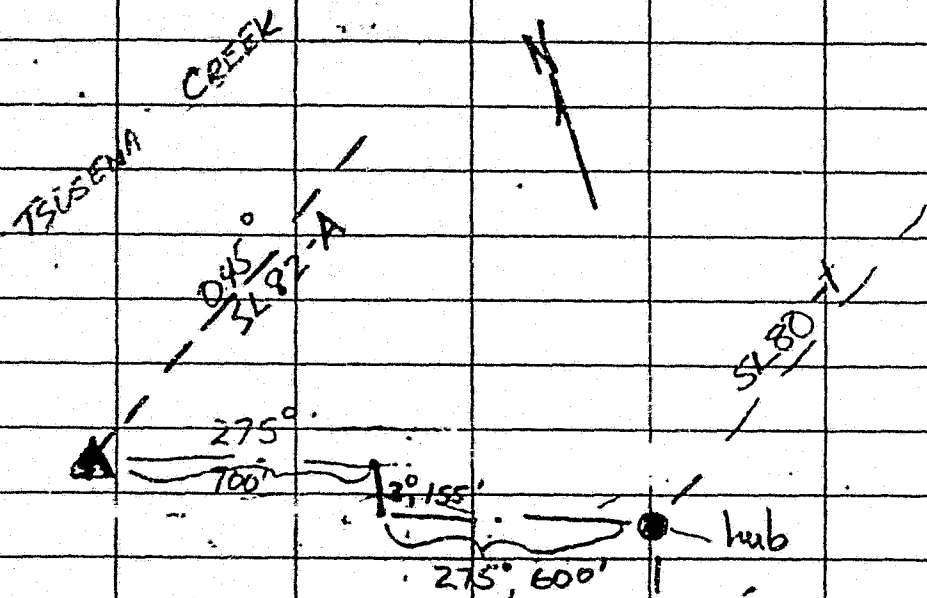
WATANA	2234'	@ .670	@ 49°
--------	-------	--------	-------

It would be to our advantage to delay the priority of AH-I/HD-B for the purpose of maximizing the location of this hole along SL82-A, after the results on the seismic survey are in. Likewise AH-K/HD-C on SL82-B should be delayed.

If possible, ... shorten SL82-A on the northeast end by 1000' and then turn NW towards Tusena Creek. Check tomorrow morning.

7-11-82

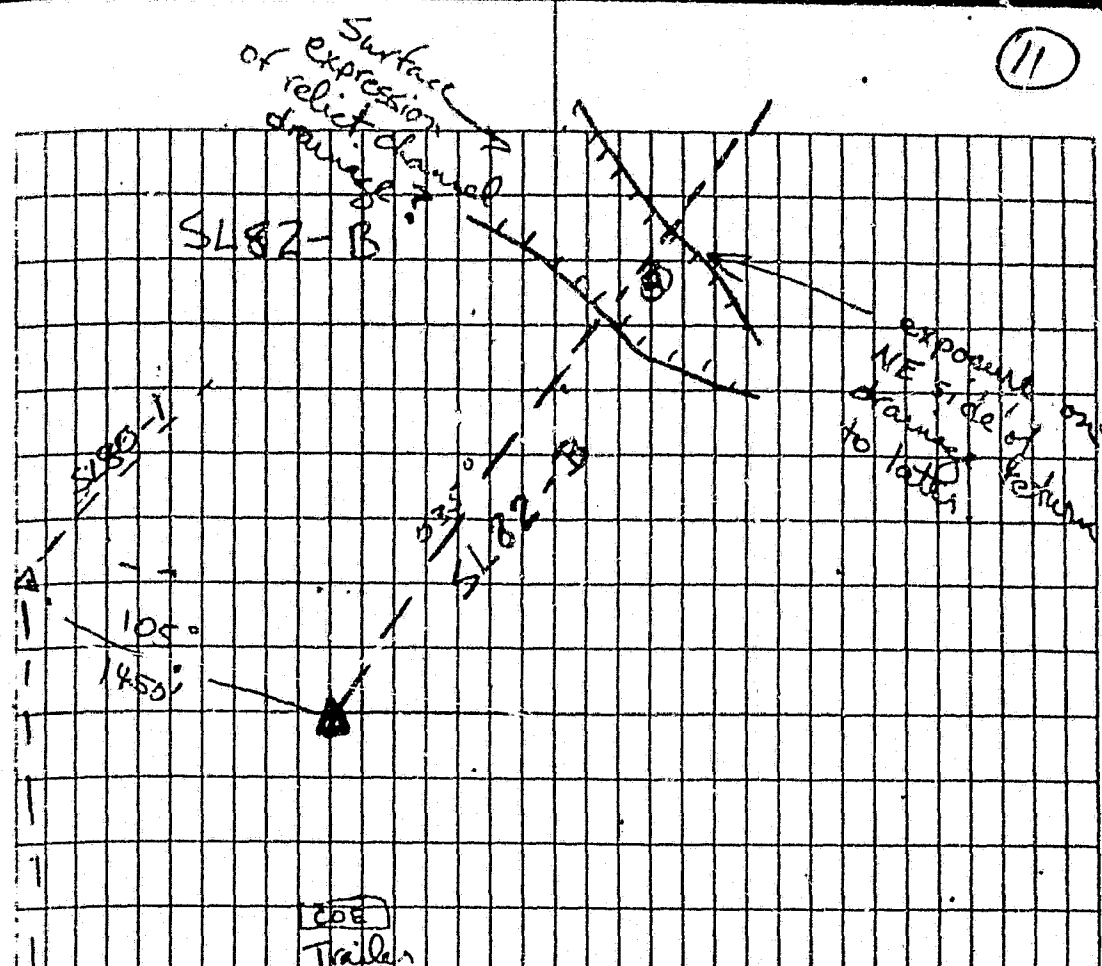
Watanabe 2260' @ 6³⁰ @ 45°



END OF SL82-A ; south west end :
2103' @ 8³⁹

Hub is located at turning point on
SL80-1.

11

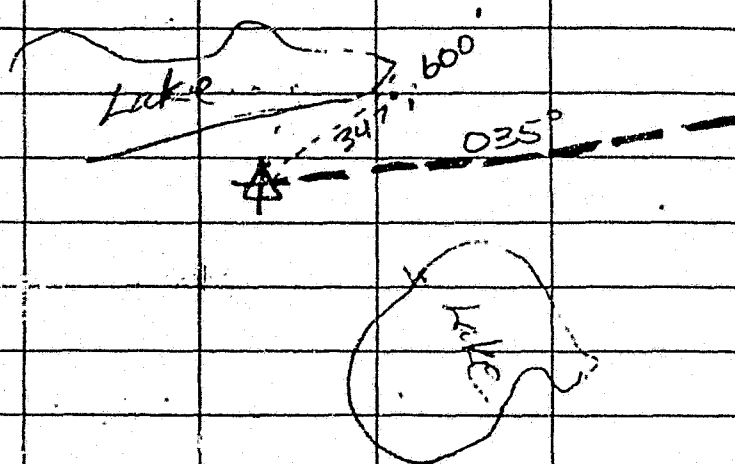


(iv) 2096' @ $10^{\circ}30'$ in draw of
drawing which empties into
Tussock Creek.

- exposure on NW/SEA ^{side of} drainage needs to be looked at for identification of soil type.

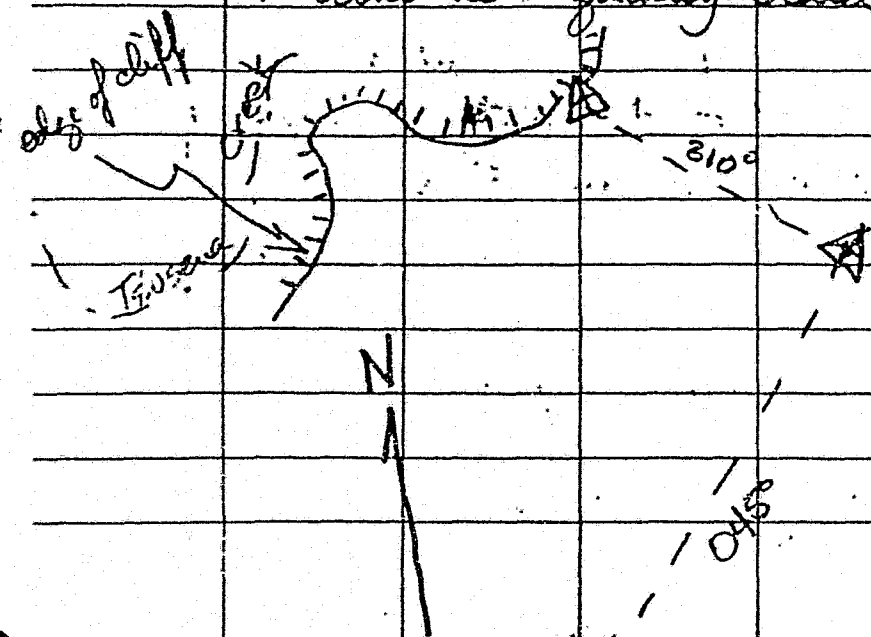
End of SL82-B

2278' @ 120°



Back to work on SL82-A

shortened the NE end of the line as originally laid out



Walked to Junction of DM-A/DM+B
Finally found it! Will stake this
for future reference. PT-B, FL,
1975.

AH-C is adjacent to the rebar

260' 30'

ELEV. 2399' @ 5° @ 56°

- two large shot holes adjacent
to the rebar

- needs brushing, drillers may
want to move the site slightly.

WATANA 2286' @ 5° @ 56°

Finished SL82-A and B. SL82-A
was changed somewhat from the initial
layout on 7-9-82. Have located
AH-C - stake the rebar.

C, D/K, E, F, G

UNIT G

7-12-82

It is overcast & raining this AM.
Will work on reviewing the data collected
during the past two field seasons in the
Tsusena to Deadman Creek area.

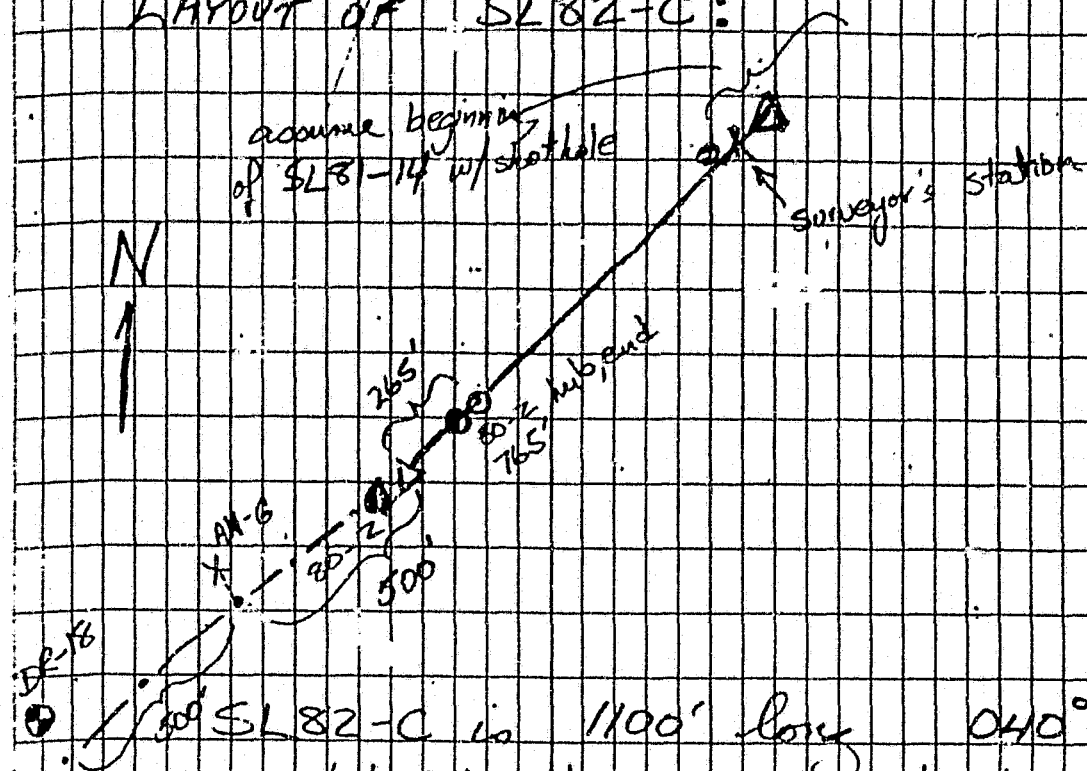
Office work, rained all day.

7-13-82

It's cloudy & overcast. Will
get brushes going on AH-G, C, & F.
ARCHAEOLOGIST'S will clear AH-C.
Will lay out seismic lines today.

Wataria	2260'	@. 6 ⁵⁰	@ 44 ⁰
---------	-------	--------------------	-------------------

LAYOUT of SL82-C:



SL82-C is 1100' long 040°
● shot hole, old ones - come back
for work at

ELEV (NE end).

- 2207' @ 85E

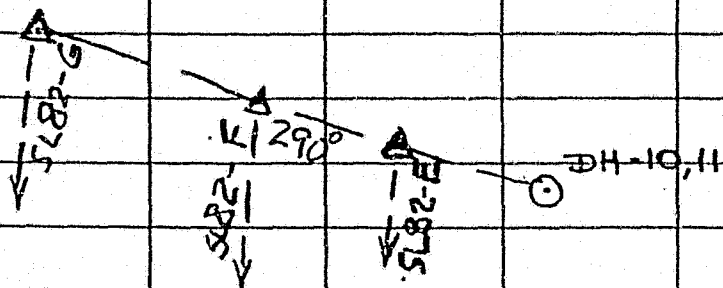
ELEV. (SW end)

2265' @ 9'13

- will now layout seismic line on the north abutment.

(16)

Started walking from DH-10, 11



ELEV. SL82-E top
2103' @ 12³⁷ @ 64°
400' from DH-10, 11

SL82-F top
ELEV. 2132' @ 12³⁹
- 800' from DH-10, 11
- is NE of BH-1

SL82-G top
ELEV. 2171' @ 1122

(17)

- is just upslope E to the N-NW of BH-1
1250' from DH-10, 11

Started walking down SL82-G, is a very steep slope, 35° to 45°. Had to stop above river level at the top of a vertical cliff ~ 45' high. Estimate that we are 150' above river level.

ELEV. SL82-G
1691' @ 245 @ 67°

- may be too difficult of a slope to have seismic crews work on. Hold the brushing until geophysicist figures it can be done.

* Make chart on seismic lines progress. i.e. layout, archeology clearance, brushing, types of brushing, etc.

Started down SL82-F. Poor results.
 Couldn't get below elev. 2000' because
 of access.

LAYOUT OF SEISMIC LINES?

SL82-D appears to be okay

SL82-H probably can lay out
 as have walked from BH-6
 to BH-2 before.

SL82-I will be shortened slightly as
 it won't reach SL82-F. Will end
 at the base of a cliff

SL82-F: no upper portion $\approx$ 1900' - 1950'.
 Start from the river and run the
 line to the base of the cliff

SL82-J will have to end at end
 of SL82-I. Maybe add a short
 segment down below the cliff to
 finish it off.

SL82-G was shortened as it ended
 at the top of a cliff. When
 SL83-111 is done on the river
 extend the northern segment to
 the base of the cliff. Below the
 end of SL82-G

* NOTE: Beneath the BH-8, 12 on the
 south abutment, just below the crest
 of the cliff is a large accumulation
 of rubble, much bigger than last
 year. The additional water from
 BH-12 may be accelerating erosion.

- Good location at end of SL82-F
 to observe & add to outcrop map on
 the south abutment area

Layout of SL82-E down to river level:

- line follows a topographic low down to the river
- meanders somewhat going downslope
- upper small segment ~ 225' - 250' on the horizontal was at 170°
- rest of line is at 175°
- lower: 200' to 250' in elevation is in a talus/scree slope boulders to 6'-8' across, aver. 3' to 4'. Estimate minimum thickness of 6'

ELEV @ RIVER LEVEL

1548' @ 5^{32} $62^\circ - 67^\circ ?$

Watana 2328' @ 6^{40} @ 58°

After being picked up, observed that the bottom part of SL82-G near the river would only be between 100' to 150' long. This could be added on to the river seismic line this winter.

Because of the cliffs and the steepness of the slope on the north abutment, all seismic lines may have to be adjusted. At the present time it is unknown.

whether the seismic crew will be able to maneuver easily enough so that those lines layed out may be completed.

For tomorrow:

SL82-H live. DH-8,9 @ 275°
1800' - 1925' (1800-1850')

SL82-D live. BH-6 @ 275°
1600-1650' to 1550'

(22)

7-14-82

Mostly sunny morning, high cirrus clouds. Will continue working on laying out seismic lines on the north abutment

Watana 2260' @ 64° @ 48°

- ① Begin layout of SL82-H starting from BH-2 drill pad. Using fluorescent orange on this line as we are temporarily out of yellow
- western segment will be abandoned because of a steep gully.
 - start line from DH-8,9 and work till the gully

- ② Started line SL82-H from DH-6,7 this time. Will go as far as we can @ 285°. We are taping this one and

(23)

marking every 100 feet

- crossed SL82-E @ approx 760' from DH-6,7 in the talus/slope pile which is ~ 100' across.
Elev 1689' @ 94° ~ 60°
- intersection w/ SL82-F @ 1180'; elev 1680'
- intersection w/ SL82-G @ 1660'; elev. 1770'
- 1215' to 1250' talus slope boulders to cobble size
- good control pt. location @ ~ 1250', lots of fallen rocks, good visibility of south abutment

Since approx 1200' have been in talus/slope generally 2'-2.5' average, old slope as it is vegetated. At 1450' to 1600', a large relatively fresh talus/slope is exposed. Average size 3' to 3.5' but up to 7' across very angular. Cornices with a chute bearing 350°

and lines up with a large gully on the opposite abutment. Some boulders have ~~are~~ partly moss covered, while others are free of any moss indicative of ^{an} active slope.

- Potential point for the cond. of survey at 1600'

Actual crossing of SL32-G was at 1660' fti.

ELEV. 1751' @ 11³² @ ~63°

END OF SL82-H ~ 1800' long

ELEV 1762' @ 11 ⁵³ @ ~67'

~~Unmarked & not signed~~

SL 82-56

Started layout of bottom segment of SL82-5. (4) The NE end ends at a bedrock cliff.

ELEV.	1782'	@	105	@	269°
-------	-------	---	-----	---	------

- will now go to the river

- back to using yellow tape

- azimuth: 239°

NOTE: Downstream portal mapping can go up to elev. 1780' at the base of the bedrock cliff, maximizing bedrock exposure

Ended the bootless segment of 5482-J on the top of a bedrock cliff. Too difficult to descend any further down to river level.

16.5' @ 1/45 Bottom

This wire may be too short?

SL82-F

Top ties into bedrock cliff.

1783'	10	3	15
-------	----	---	----

- see if line can extend upslope for any great distance

- completed SL82-F down to the river
- will need heavy brushing

SL82-D

- started just east of BH-6 & the line has an azimuth of 285°
ELEV. east end of line, $\approx 100'$
 $1692'$ @ $435'$
east of BH-6.

- at 670' from BH-6, crossed SL82-E

- at 900' from BH-6, groundwater was seen seeping from the moss/vegetated talus slope.
- there is a good deal of talus along this line
- needs heavy brushing

Wakana $2315'$ @ $645'$ @ 56°

All lines on the north abutment so far will need heavy brushing. As with the lines completed yesterday adjustments were made due to site conditions. In summary:

SL82-H - changed to 285° azimuth
- shortened, doesn't go all the way west to BH-2

SL82-J - bottom segment below the $\sim 1800'$ elev. bedrock cliff.
- did not go to river level because of a lower cliff

SL82-F - starts beneath a cliff @ approx. $1775'$ and continues down slope to river level.

It will be beneficial to walk these lines later for the geology. Also there are a couple of potential control points along the lines.

7/15/82

It's cloudy with a low ceiling, will probably rain again today. Continue layout of seismic line on the north abutment.

Watana 2260' @ 6⁵⁰ @ 45°

S482-D :

Will finish this line this morning. The elevation at which the groundwater table intersects the slope is:

1530' @ 7²⁰

Start : 900' from BH-6. 285°

- at 1368' there is a large outcrop exposure which "atches" for ~100'. Definitely map this area for detail

- because of the terrain S482-D will be changed to 1340' & go @ 275° to the river

On the river @ 1740' from BH-6
ELEV 1456' @ 9⁵⁰ @ 56°

- total length of S482-D is 1840 feet.

Downstream Portal Control Points :

- set two up

- one at river level approx. at the spot of a control panel
DP-1

- another approx 100' up and 100' d/s of DP-1; DP-2

- get helmets and rope for this zone

- the portal control points are being marked up/ orange flagging on a tree and ~~X~~

(30)

DP-3 ... SL82-D crosses this point within 10'. Birch tree is flagged. Need to remove the adjacent birch tree and spruce to allow for a clear view.

ELEV. 1522' @ 12° @ ~59°
- point is at 1340' along SL82-D at the turning point.

DP-4

Approx @ 1100' from BH-6 and just a few feet upslope. This point is approx 70' upstream of where SL82-F crosses SL82-D.

ELEV.

1545' @ 10°

Birch tree is flagged

(31)

DP-5

Just above SL82-D and just west of SL82-E on the talus/spruce slope. We are approx 150' from BH-6 (estimated).

ELEV. 1568' @ 12° @ ~60°

May need some minor brushing

DP-6

Is along SL82-H approx 725 ft from DH-6, 7. It is also approx 25' upstream of SL82-E. Spruce tree is flagged.

ELEV. 1657'

DP-7

Just upslope of SL82-H and 4/5 up SL82-E. A broken birch tree is flagged. Site will need brushing.

ELEV. 1711' @ 2° @ ~61°

DP-8

Is uplope of SL82-H @ approx
1650' from DH-6,7. It is at the
base of a cliff on a steep slope.
A spruce tree is flagged; may need
some brushing.

ELEV. 1729' @ 247° @ $\sim 63^\circ$

NOTE:

The end of SL80-2 ends just
below BH-1. BH-1 hole is not
numbered and needs a stake.

SL82-Ja

Start the upper layout of adjacent
to SL80-2 end pt. $\sim 5'$ lower in elev.

- go 50' east
- at 600' SL82-E is
just downlope $\sim 100'$ @ 175°
- at 1100' BH-3 is at azimuth
 155° @ approx 100'
- isent a total distance of 3300'
- line is along 239° azimuth
- minor brushing is needed
- elev is a few feet lower than DR-19?

The northeast endpoint is approx.
293' from DR-19 along a 210°
azimuth.

Finished the following seismic lines:

SL82-D

SL82-J

In addition the control points for the
mapping in the downstream portal
were chosen & flagged. A total of 8
points were chosen DP-1 through DP-8.
Brushing will be necessary at most
of these sites.

Wetana 2318' @ 750

(34)

7-16-82

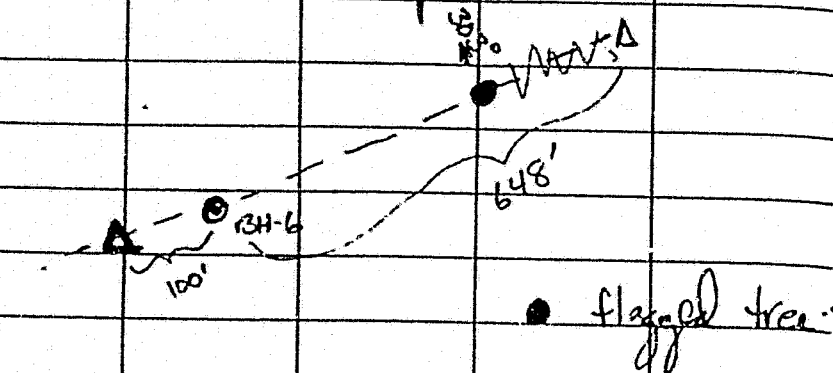
It's a cloudy overcast morning.
Will work on seismic lines and
control points on the north abutment
up of C/L

Wataru

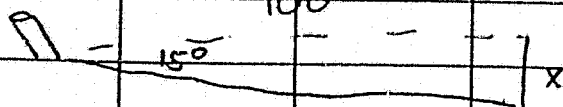
2260' @ 6⁴⁵ @ 43°

SL82-Ka

- azimuth (253°) 73°
- start and overlap at BH-6



BH-L



x =

hgt. below BH-6
est. 10-15'

(35)

- will tape this one from the SW end point ~~changed~~
- end of segment 748' long
ELEV (NE) ~ 1622' @ 8⁴⁵
@ 55°

- ✓ - geophysicist may not want to go beyond 520'. Going begins to get rough after that
- could offset a segment in the middle over the gully

- ✓ - go only till 500' the flagged tree and then proceed upslope, will have an offset center segment.
ELEV. 1681' @ 9³² @ 56°

SL82-Kb

- ~ 303° from easternmost endpt of SL82-Ka at elevation 1852' @ 9⁵¹ @ 56°
- at azimuth (253°) for 850' @ 73°

(36)

- @ 530' small spring in the hillside > gal/min.

- total length 900'

ELEV. (NE-E)

1884' @ 10⁵⁵ @ ~60°

- will proceed down to SW end of SL82-Kc @ 160' at approx. 1600' elevation

SL82-Kc

- down hill @ 160' azimuth to ...

1628' @ 11⁴⁶ @ 60°

- tape back to quarry

- at azimuth 253° @ 70°

ELEV. ~ 3' lower than the

1628' figure

- will go @ 73° for

- good cliff exposure beginning @ 450' from SW end

* - @ 473' good location for observing rock outcrops on the south abutment.

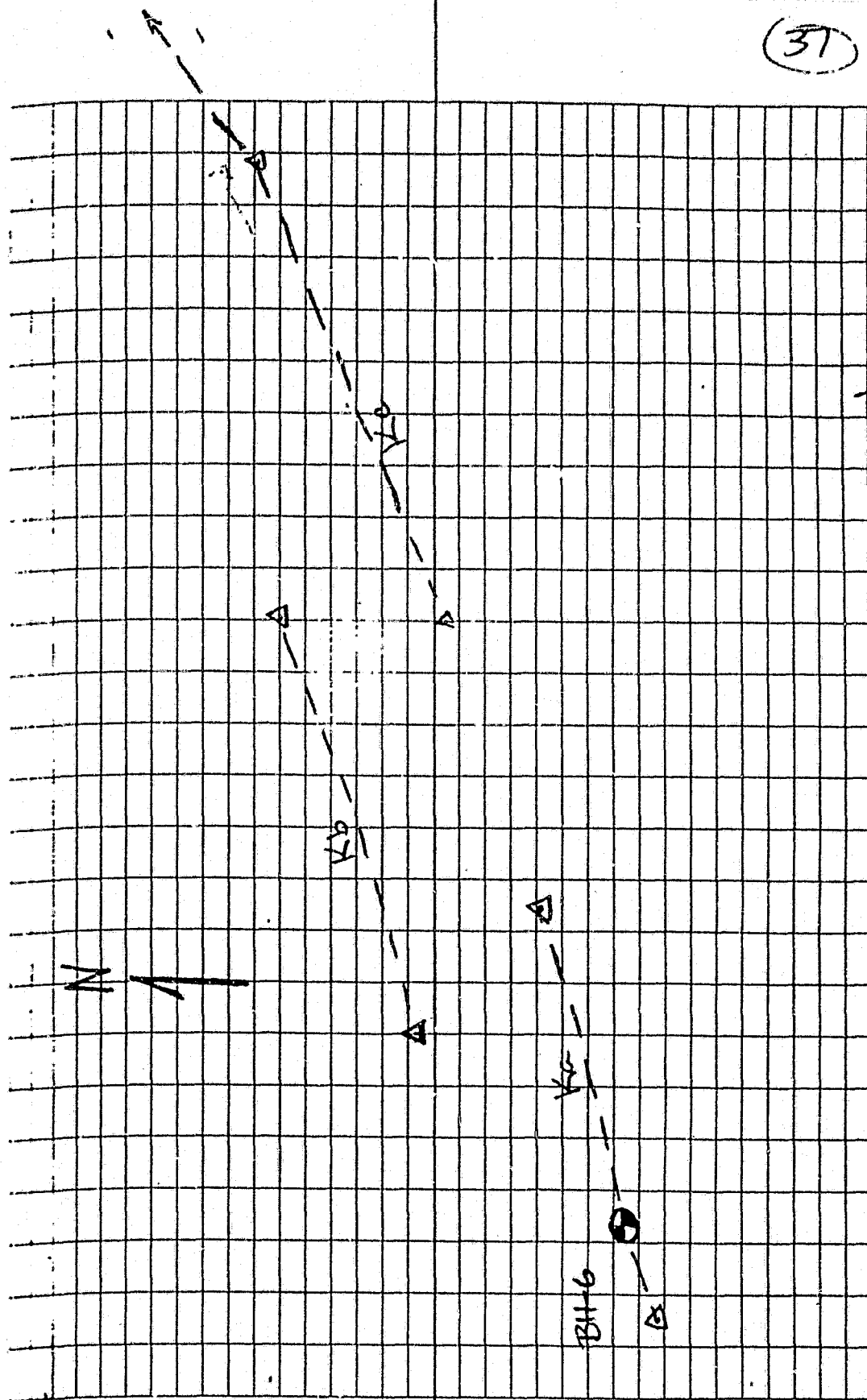
- panorama of south abutment

d/s → u/s total of 15 pix

K8Z-1-6

then 21 - 1 pix @ 147° azimuth, looking horizontally across.

(37)



(38)

- crossed SL80-3 @ 657'
- previous line at 73° azimuth
- total 1100'

ELEV. (NE-E. and pt.)

1715' @ 125° @ 60°

- next segment will not overlap with this point, this will be just a turning point and a continuation of SL82-Kc

- change to azimuth 47°

- ended SL82-Kc at 1800' at the edge of a gully

ELEV.

1738' @ 342° @ 25°

- thick brushing along line

UPSTREAM PORTALS

UP-1

- located just below end point of SL82-Kc

ELEV.

1707' @ 337° @ 59°

- flagged a birch tree

1707

(39)

- need to clear only a couple of trees.

UP-2

- is on the side of a knob, point
- birch tree is flagged, minor brushing is required, depends on where the survey crew will set up.

ELEV.

1691' @ 445° @ 57°

- further u/s than UP-1

UP-3

- is on a slope ~ 100' from the river, just above the proposed helo pad
- birch tree is flagged, minor brushing is required

ELEV. 1576' @ 50° @ 58°

- exactly down slope of UP-2

(40)

UP-4

- is along the slope d/s of UP-3
- spruce tree is tagged, brushing will definitely be necessary
- ELEV. 1554' @ $5^{\circ}36'$ @ 57°
- is just d/s of bedrock exposure

Watana 2270' @ 6° @ 52°

Still have to get one or two more control points established at the FNS. To date, a total of ~ 27,900 lf of seismic lines have been layed out. Rained most of the day.

(41)

7-17-82

Mostly cloudy morning but it looks like it may burn off. Will work in the office today. Worked on Progress Charts discussion of surficial mapping.

TRIP to BH-12

- measured the outflow from the borehole 3 gals/min.
 - took pictures of the slide below
- Checked to see if the brushed drill pads were large enough, they looked okay.
- Removed items from COE Trailer

7-18-82

Steady rain last night and this morning. Looks like it will rain all day. The plan was to begin mapping in Deadman Creek.

2260' @ 6³³ @ 45°

Rained steadily for much of the day. Worked in the office on repotting the geologic traverses on 1" = 100 ft maps.

7-19-82

It's a beautiful sunny morning. Can see Denali today. It's the first nice day since our arrival and will do much more morale. Will work in the Deadman Creek area on mapping.

Wataana 2260' @ 6²⁶ @ 54°

T.L. 11/1/82

On east bank of Deadman Creek (2120')

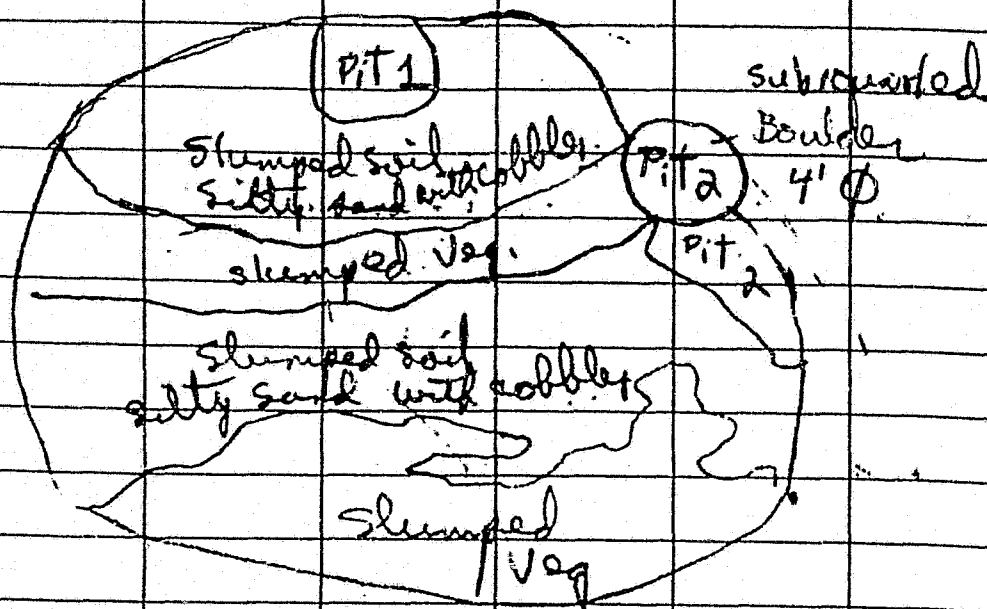
(W) 582-1 Elev 2112' 0700 hrs 67°F
Location marked on Airtphoto
2-6-4. Fresh exposure at
head of small stream (50' x
80') Scarp oriented 345° on
15° slope

Upper Soil is saturated and flows.

Stratigraphy is difficult to decipher due to flowage in upper units.

(44)

Top of Ridge



PIT 1

From surface:

0-1.5' Vegetation + Humus

1.5-2.5 silty sand, well
graded, cobbles; fine to coarse
sand, dark brown, with
lumps and is saturated
dark yellowish brown 10YR 2/2

2.5-2.9 Clayey sand, poorly
graded; 10% gravel and
cobbles, cobbles to bins,
some with striations and

(45)

polishing, fine sand, 20-30%
light plastic clay,
moderate yellowish brown
10YR 5/4

2.9-3.5 bottom of pit
gravelly sand, well graded,
10-20% fine gravel to 10 in
max., fine to coarse sand,
10-15% silt
Dark yellowish gray, 10YR 4/2

PIT 2 Top is 1 ft below bottom of
PIT 1, 25' NW.

Overlain by boulder

0-0.6' Gradation from
Silty/clayey sand, poorly
graded, fine, saturated,
dilatant, non-plastic,
slumping, some cobbles, and
cobbles subrounded, striated
and polished Dark yellowish brown 10YR 4/4
Gradation to:

0.6-2.7' Sand, poorly graded

(116)

15% fines
83% fine gr. sand } silty sand

Sample A → fine to medium, moist, non-stratified, Dark yellowish orange to moderate yellowish brown

Grades to a sand, uniform, fine, trace silt, olive gray, moist. Possible alluvial

UNIT DOW
E & F

outwash

Active layer thickness
3.3 ft

20-25% visible ice in samples. crystal sized fine sand also some 1 mm thick ice lenses ~ 2.5 inches

2.7 - 3.6 Bottom of hole

Sand, well graded fine to coarse, less than 10% silt, mostly medium pebbles and lenses (to 0.5 in) increasing towards base (may grade to till) elongate,

(47)

Sample B 3.6'

Silty Sand

35% fines

46% fg. sand

15% med. gr.

Some polished pebbles to 0.5 in

Elevation 2112' at bottom of Test Pit 1

W-82-2 (Sketch on P 51)

Top of east bank of Derchman Creek Valley, hummocky surface above. Orientation of crest is approx. due north

Elev. 2221' @ 9°33' @ 70°

Pit 1. (2232')

0.0 - 0.8' Vegetation, topsoil

- Devil's Tongue < 2" 1-2"

- silty sand below the ash

0.8' - 5.5' "grave" sand crude stratification! alternating layers of fine to med. sands and coarse sands & gravels. Generally thicknesses of < 2" but up to a foot. Generally range of cobbles is 1" to 6" with boulders to 1 1/2'. Cobbles are

OUTWASH
E & F?

generally subrounded, some subangular and angular. Approximately $\approx 5\%$ are polished and striated

Percentage of gravel size 25-35%

Partly to poorly sorted.

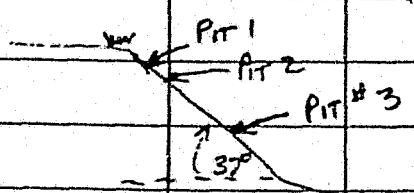
Stratification is 0° 25° E

Material is dry, cohesionless, loose. Pale yellowish to dark yellowish brown medium grained sand. Cobbles have occasional silt coating ($< 1\%$).

Sample W82-2 Pit 1

Sandy gravel GW

48% sand 52% gravel



Pit 2

S.O. 7.5' Silty sand with gravel & cobbles

Cobbles are subrounded, generally less than 6". Matrix is a fine sand to silty sand; damp, ^{today} loose. Contains what appears to be pockets of sandy silt with gravel & co. sand, damp, hard, non-plastic. Some medium grained sand at the top of the profile. Material is dark yellowish brown.

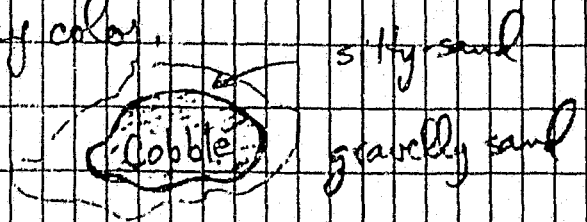
OUTWASH UNIT E1F

- difficult to tell if the fine-grained pockets are actually the crude stratification

Pit # 3 (2215')

ELEV. 2198' @ $11^\circ 15'$ @ 68°

Gravelly sand like Pit #1 above, more sorted than above, less gravel & cobbles. Crudely stratified. Some layers or pockets of silty sand with co. sand. Damp to moist, ~~loose~~ silty looking - silty sand with coarse grained sand in pockets around cobbles. Olive-gray color.

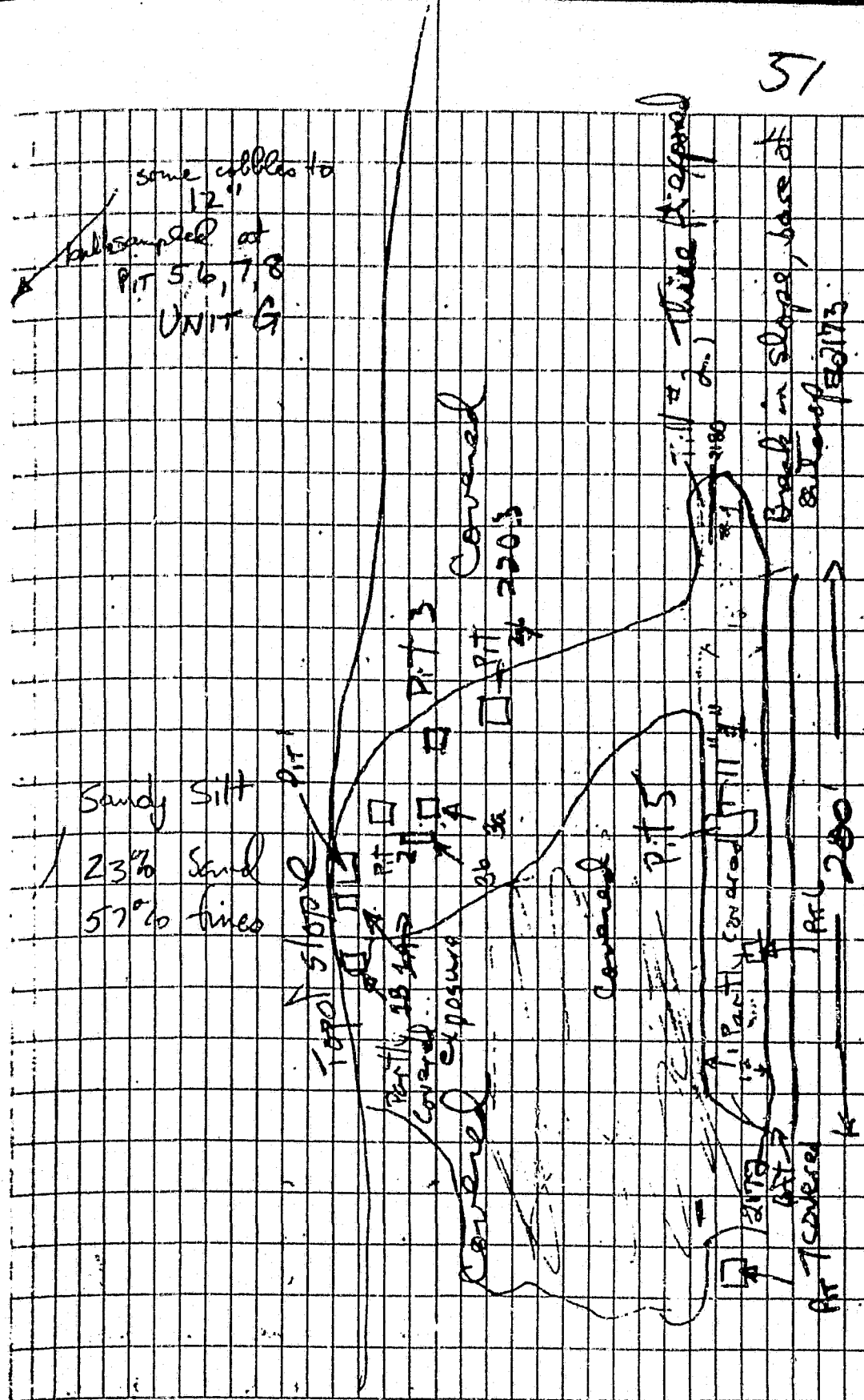


Percentage of cobble/gravel $\sim 10\%$

Pit is questionable, approx 30" deep

OUTWASH - UNIT E1F?

some of plastic clay
mod. dense to dense
gravel - cobbles. subangular to
subangular some angular
up to 14 small gr coarse gravel



few dots with striations
contact with Till #1
marked by iron oxide
staining, undulating, mottled
marked density contrast
from higher density #1 to
lower density #2

fine gravel
layer

ELEV OF CONTACT

(2202') 2180' @ 12° @ 70°

Color of Till #2 dark yellow
brown to olive gray

Contact appears to dip
outward

3ft exposed above #1

Pit #4 at 2203ft 12:50 PM
(2226')

0-1.2 Sandy silt, slightly plastic
15% gravel and cobbles to
5 in max, gen 1 to 2 in
subrounded, 10-15%
fine to medium sand,
moderate olive brown,

OUTWASH
UNIT E, F

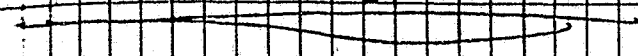
1.2-1.7 Sand, uniform, fine, less
than 5% fines, moist
loose, dusky yellow

1.7-3.4 Clay, highly plastic,
moist, soft, laminated
with layers of silt, sand
with gradually layers,
up to 0.3ft thick
medium dark gray,
locustine clay

UNIT
& E/F
thin
layers

Sample W82-2 P314 Clay?
1.7 ft is EL 2203ft 88% fines

Top of valley (2239')
2211' @ 21' @ 75°
- will go lower down towards the
river



(54)

EL

THK

2221

Gravelly to Silty
SandOutwash
or Alluvium

18'

1/F

2203

1.7'

Calcareous Clay

G

covered

3'

Till 2 Sandy silt

?

2207

2180

12'

Till 1 Sandy silt

I ?

2172

- 3 -
covered

(55)

W-82-3 (W-80-282)

As noted previously when walking down this slope to this mudflow, the entire slope is flowing beneath the tundra mat with the roots of spruce trees holding the entire slope from flowing into Deadman Creek. The samples taken previously as well as the determination of the material are all suspect.

The mudflow is on a 19° slope which faces 290° . Dark medium gray clay, moist to wet, soft, cohesive, moderate plasticity. Well sorted with $\leq 10\%$ gravel and cobbles. Much of the gravel & cobbles on the surface (float?) are subrounded, elongate, & striated. Average size is 1" to 3" but up to 5". No lamination were observed in the clay.

(2068')

2038' @ 255° @ 78°

If the material is frozen, the whole active layer may be flowing downslope. The same will occur in frozen areas where the slopes will thaw upon

(56)

reservoir impoundment

W-82-4

Bedrock outcrop adjacent to the creek. Outcrop is 12' high and 125' long (1958')

ELEV. 1928' @ 3³³ @ 72°

Medium to coarse grained (primarily, medium grained light gray biotite granodiorite. 40-50% biotite. Subhedral to euhedral. Massive, hard competent. Est. 10-20% quartz (?).

Guided to a light rusty orange. Blocky w/ two major joint sets

JOINTS:

SET 1 { 350° 85° E planes smooth
330° 80° NE 1'-3' aver. 2'

SET 2 85°-100° aver. 90° planes, rough
85° N 1' to 4'

W-82-5

Around the bend in the river, bedrock outcrops on both sides. Avs. ~15' high above the creek

ELEV. 1964' @ 4⁰⁰ @ 73°
(1997')

(57)

W-82-6 PIT 1

Slump exposure just above creek level. Orientation of 305°, sloping 30°. Appears to be a stratified, fine grained well sorted sand. Damp, loose, uniform 25% fines. Light olive gray.

Interlayered very thinly with a sandy sand. Well sorted w/ 20-30% non-plastic fines, light to medium, moderately dense, uniform olive gray. Numerous cobbles on the surface.

Shingled W-82-6 - OUTWASH UNIT

ELEV. (2021')

1985' @ 4³⁴ @ 73°

if the slump are striated

PIT 2

Gravel to

Sandy gravel, poorly graded. Cobbles range from 1/2" to 1", mostly subrounded & a few are angular. 20-30% sand. Fine to coarse but mostly medium grained. Non-plastic fines 5-15%. Possibly an outwash / alluvium.

Approx. 25' below PIT #1

* May not be in place

Sandy silt (?) 28% sand
67% fines

It appears that much of the upper foot or so of soil may be flowing beneath the vegetation mat. Bedrock is exposed at river level across & upstream of this slide.

W-82-7 *

Large massive outcrop ~ 25' high and several hundreds of feet long. Begins at river level. Gray-white medium grained biotite rich granodiorite(?). Believed to be quartz but unsure. Same mat'd as W-82-4. Massive, blocky outcrop, large talus blocks at base (up to 8' across). Numerous fine grained veins and dikes crosscut the outcrop. Rock is hard & competent.

JOINTS:

320° vert. plane, smooth
6" to 10' over. 2' to 3'

350° 75°W plane, smooth
- fracture zone 1.5' wide along the 320° set

290° 40°S plane, smooth

several inches - 10', discontinuous
45° 20°SE plane, smooth
discontinuous > 10'

Bear territory! Signs all over the place. Good place for a den.

Elev. 1908' @ 52°
(1947')

Natana 2216' @ 61° @ 72°

The stratigraphy from the top of the valley to 2172' has two possible interpretations. The gradations which will be undertaken will shed light on the subject.

	#1	#2
2221	UNIT C Unit E, F	UNIT C UNIT E, F
2203	UNIT G	UNIT G
	Sandy Till Basal Till	UNIT I

Unit I - could also start at the Sandy Till, basal till interface. Don't think that the outwash is Unit C.

7-20-82

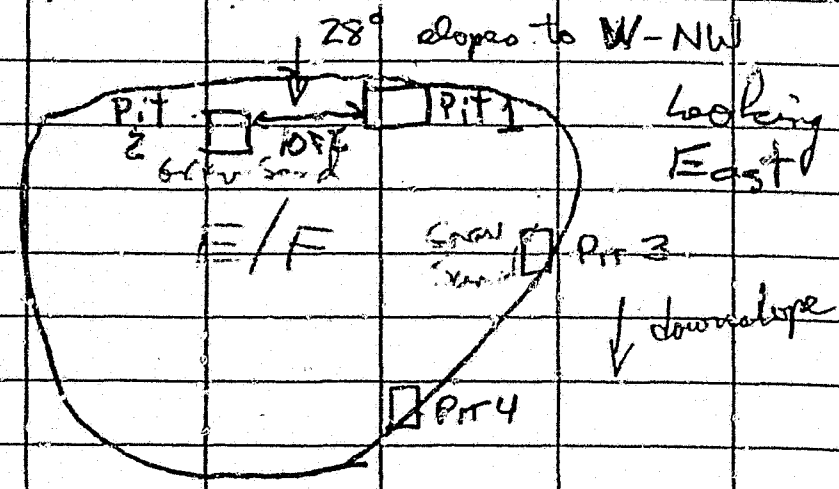
It's another beautiful sunny day.
Need to show the archeologists the meander
lines laid out to date for clearance.
After we will continue the mapping in
Deadman Creek.

Assume Watawa 2260' @ 7°
Archeologists found a "site" on
SL82-A

On Deadman Creek

W82-B

Location shown on airphoto
4-3-33 section C-1



(2230')

PIT #1 ELEV. 2253 @ 10° @ 68°
at base of pit

Exposure in pit is 3.0'. Primarily
a gravelly sand. Poorly sorted / well
graded. Approx 30% gravel with a
general maximum of 1', average
2". Cobbles & gravel are subangular
few subangular, < 5% have striations.
Fine to coarse grained sand, primarily
medium (to coarse) grained. Approx.
5-15% fines in the exposure. Peds
and lenses of a sandy silt, non
plastic, estimate 20% sand. Moist,
loose to moderately dense.

Granitic cobbles, biotite rich, medium
grained are decomposing breaking along
the grain boundaries.

Sand is a pale to moderate yellowish
brown.

PIT 2 is the same as PIT #1, Top
is level with the base of #1.

Exposure has numerous cobbles and boulders
on the surface up to 18".

OUTWASH Unit E & F?

(62)

PIT #3

Concentration of cobbles ~ 2.5'
down from the surface. PIT is 2.5'
deep. Material is the same as at
PIT #1 & 2

Elev. 2248' @ 104° @ 68°
(2221')

PIT #4

Similar to the other pits except
there is an increasing amount of fine
gravelly silty sand. Some thin
oxidation lenses, or surround some
cobbles, dark yellowish orange

Elev. 2238' @ 104° @ 68°

- no decomposed granitic cobbles
- at base of exposure
- all above in outwash

(2216')

(63)

W82-9 moved L/S from
82-8

Dug pit from top of bluff
down 6ft (2239')

0 = EL 2266 @ 11:30 70° F

0-3.7 Sandy gravel, poorly graded
fine to coarse sand, mostly
coarse, boulders to
4ft max, av. 2ft,
subrounded, some subangular
moist, loose, unstratified
high energy environment
oxidation to 2.0ft.

3.7-6ft (bottom)

Gravelly sand, poorly
graded, fine to coarse
mostly medium 35% cobbles
subround to round, av 2 in
to 6 in max. faint
stratification of fine sand, and
medium to coarse sand, pale

(64)

yellowish brown,
stratification appears to dip
 $\leq 10^\circ$ to the Southeast

OUTWASH UNIT, E & F

W-82-10

Going down slope along a ridge. Same material is exposed, outwash. Don't know if the outwash is following the topography or it is actually this thick. Gravelly sand Pit is 4' below the vegetation

ELEV. 2224' @ 12" @ 75°
(2192')

W-82-11

Large exposure at the end of the ridge just above the creek level. Exposure maintains a 50°-60° slope, too dangerous to go on

ELEV at base

2125' @ 12" @ 74°
(2092')

PIT #1

(65)

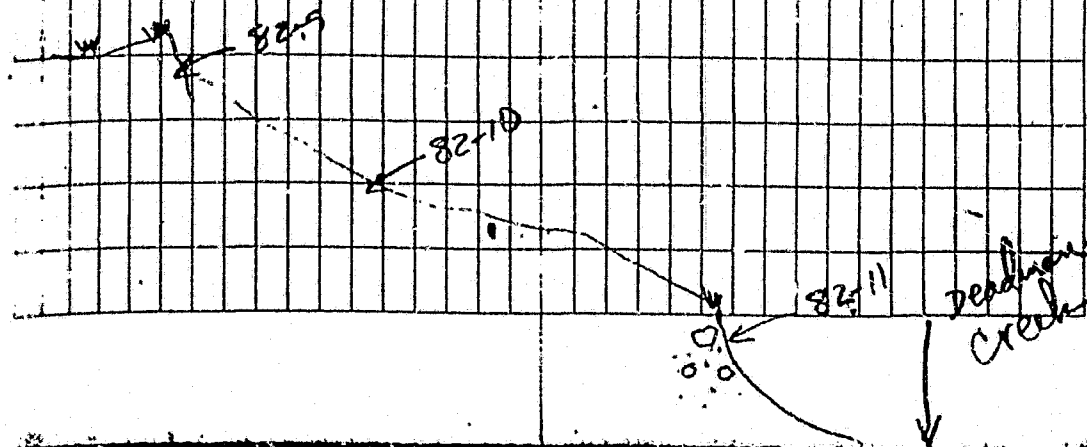
Exposure is roughly 30' high. Gravelly sand with increasing amount of fines, both silt and clay. Increasing amounts of pods and lenses. Gravel ranges from gravel to boulders. Comprises roughly 30-35%. A crude stratification of sandy, silty sand, and sandy-clay layers. Cobbles & boulders are primarily subrounded with some rounded and few subangular. Matrix, moderately dense, partly to poorly sorted. Cobbles and boulders range from 3" to 3', w/average of 3".

ELEV. of pit (2113')

~ 2150' @ 10" @ 74°

A few clasts are striated. Outcrop face appears to have some boulder lenses, approx. horizontal

OUTWASH UNIT



(66)

Sandy clay — dark greenish gray
 Med grained sand — dark yellow brown

PIT #2

Sandy gravel, poorly graded. 20-30%
 Fine to coarse sand, primarily medium
 Cobbles range up to 10" with an average
 between 2" & 3", subrounded. Moderately
 dense, moist, cohesionless. no stratifica-
 tion. Contains weathered granitic
 fragments. Mottled — dark yellow
 brown to dark yellowish gray.
 Approx 25' below PIT #1

PIT #3

Approx 12'-15' below PIT #1. Sandy
 gravel similar to PIT #2

OUTWASH UNIT

W-82-12

Bedrock outcrop at creek level.
 It's approx 15' high and extends
 roughly 100' farther upstream. Outcrop
 is blocky. Medium grained, white
 rich granodiorite. Hard, competent.

(67)

JOINTS:

20° 85° W. plane, smooth — slightly
 rough; 6" to 2', aver. 1.5'

50° 70° N plane, smooth — slightly
 rough; 1'-2'

- on the opposite bank, bedrock ends
 approx 50' farther downstream.
- directly across the creek and 20' higher
 in elevation is a large old scree
 slope (the base). This indicates
 that the bedrock comes up in that
 area ~ 50' above creek level??

Elev. TOP of Rock

↑ clock

2062' @ 15° @ 70°
 (2020')

W-82-13

Exposure of a sandy gravel. The
 gravel ranges from gravel to boulders
 3" to 3' average is 3" to 1'. Matrix
 is a medium to coarse grained sand.
 Moist, moderately dense, partly graded
 Cobbles & boulders are subrounded to
 rounded. Similar to 82-11. PIT #2 & 3
 Elev. 2204' @ 25° @ 73°
 (2156')

(65)

Exposure is 15' high. Moderate yellowish brown. Sampled Gravelly sand

GW-SW 47% sand
OUTWASH UNIT 45% sand
5% fines

W-82-14

PIT #1

Silty sand, poorly graded. Non-plastic fines 10-20%. Fine to coarse grained sand, mostly medium. Approx. 12" of silty sand.

Sandy gravel, 20-30% medium to coarse grained mainly medium. Estimate 10% fines. Cobbles are subrounded to subangular with some angular. Both are moist moderately dense, medium greenish gray.

Silty sand may have flowed along the surface downslope. Cobbles range from 2' to 2', over 2" to 4."

ELEV. 2253' @ 2³⁰ @ 76°

OUTWASH (2201')

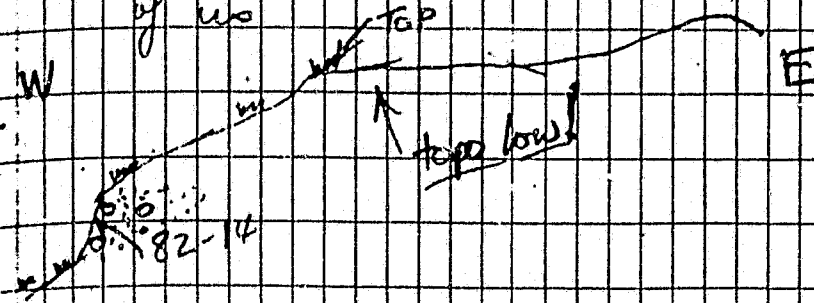
E & F

(66)

TOP SURFACE ABOVE LAST EXPOSURE

2302' @ 3³² @ 75° (2250')

Hummocky Terraces to the east of us



W-82-15

Exposure at the top of the valley



0.0' - 2.0' Topsoil, organics. Gravelly sand, trace silt. Primarily fine grained sand but there is some medium grained sand present. Moist, moderately dense, poorly graded. Gravel 25-30%, subrounded, some rounded and subangular. Moderately yellowish brown. Average size of gravel 1" to 3", up to 1'.

(Could this be alluvial deposit, unit B??) C

2.0' - 4.5' Sandy gravel. Gravel ranges from gravel to boulder size 3" to 1.5' over 3"-6", subrounded. Matrix is a coarse medium grained sand, some coarse and fine grained sand, trace silt. Moist, loose to moderately dense, poorly graded. Moderately yellowish brown.

OUTWASH UNIT E & F

ELEV. TOP OF CLIFF

2342' @ 435' @ 75°

- altimeter drifted since last measurement.

- edge of a hummocky knob (2285')

W-82-16

EXPOSURE 15' high and ~100' long

ELEV. TOP

2339' @ 430' @ 75°

at top of the cliff. (2278')

0.0 - 2.6 Vegetation mat, organic. Devil's Taphes. Moderate brown

2.6 - 2.7' Sandy gravel. Boulders are subrounded - some subangular. maximum 2'; generally 6". Most have a thin coating of silt/clay. Sand is 5-15%, fine to coarse sand, primarily medium grained. Moderate yellowish brown.

2.7' - 5.5' Sandy gravel. Well graded. Boulders are 1/2" to 6" averaging 2", gravel, subrounded. Sand is fine to coarse grained, less than 5% fines. Dry to damp, moderately dense. Occasional pods of sandy silt. Pale yellowish brown.

0.6' - 2.7' layer is the same seen at 82-9

OUTWASH UNIT E & F

W-82-17

Stratified deposit.

ELEV. BOT OF P1:

2267' @ .5²⁶ @ 75° (2204')

0.0 - 0.3 Vegetation mat, organics

0.3 - 2.0' Silty clay, some gravel.
 may be slope wash of fines down
 slope. Cohesive, moist, slight plasticity,
 soft. Not well exposed

2.0' - 5.9 Interlayered sequence of
 sands. Layers are 1" - 6" thick.

- sand 1 Poorly graded uniform
 fine grained sand, trace of
 silt, yellowish gray. Moist,
 moderately dense, aver. 1" - 2"

- sand 2 Well graded
 medium to coarse grained. Moist,
 moderately dense (but looser than
 sand 1). Layers 1" - 6"
 Dark yellowish orange.

5.9 → > 7.5' Gravelly sand. Gravel
 20 - 30%. Poorly graded. Gravel
 subrounded, aver. 1" - 2" but up
 to 6". Fine to medium
 grained sand trace coarse grained

OUTWASH
 UNIT
 ↓

E & F

sand, < 5% fines. Medium light
 gray. Moist, moderate dense to
 dense.

Moderate yellow brown 0.3' - 1.7'
 clayey silt trace sand. Moist
 soft, slight plasticity, cohesive.
 Medium light gray 6.1' - 2.0' silty
 clay.

PICTURE OF K52-1-5

Watana 2333' @ 7³⁰ @ 69°

Primarily outwash was observed in
 exposures today. Appears to be quite thick
 with good size boulders indicative of
 nearness to glacier during deposition.
 A topographic low in the underlying
 units possibly resembling a broad
 channel was filled by the deposition
 of the outwash?

W. D. P. (H. D.)

7/21/82 KVS

7-21-82

It's a mostly cloudy morning, high clouds. Will work on the west side of Deadman Creek beginning downstream and working upstream

Natana 2260' @ 6⁴² @ 57°

W-82-18

Skimp exposure, recent flowage of the material beneath the vegetation mat downslope - mud flow. Has an orientation of 75° dips 20-25° NW Exposure is 8' high & 12' across

ELEV. TOP OF EXPOSURE

2187' @ 7³³ @ 64° (2182')

Material has flowed downslope at least in part but it is only ~ 15' from the top of the slope so believe it is representative. Outcrop extends off E on for 100'

Material is a sandy clay with some coarse sand to cobble size clasts. A medium gray, wet to very wet, plastic, very soft to soft. Sand size particles comprise 10-20%. Material is poorly graded. Clasts are subangular to mostly subrounded, most are slightly elongate, many are polished 10-20%, at least some have striations (difficult to tell without cleaning the clasts)

Appears that primarily the upper 6" or so is flowing beneath the vegetation mat

TILL UNIT G ?
E/K

ELEV. 2206' @ 7⁵⁶ @ 67° (2199')

- opening in vegetation mat due to it's flowage downslope. DUG a 1' pit

Moderate yellowish brown, clayey gravelly sand. Approx 15% clay, Gravel 20-30%, 1" - 3" in diameter, a few are polished. Sand ranges from fine to coarse grained, primarily medium. Moist to wet, soft, fines are slightly

plastic. Pit is in oxidized zone.

STILL IN UNIT G - Till

W-82-19

Similar to top of slope at 82-18. There are a few thin medium to coarse grained sand layers. May

ELEV.

2235' @ 8° @ 67° (2225')

be nearing the top of unit G, outwash nearby?

Exposure is a break in vegetation, most due to flowage of water.

W-82-20

Slump exposure, flows 130°

0.0 - 1.0 Organic

1.0 - 2.4 Mixture of sandy silt and cobbles to boulders. Gravel is primarily subrounded, some subangular, 2" to 2' rounded to subangular, mostly subangular.

Matrix is a sandy silt, slight plasticity, 20-50% fine to medium grained sand, firm, moist. Dusky brown sandy silt, cobbles to boulders to 50%.

— BOTTOM OF UNIT F, interfingering with the till

2.4 - 4.0 Poorly graded, sand. Fine to coarse grained, primarily medium. < 5% fines. Some gravel to cobbles, ~15%, max. 1" - 2", subrounded to subangular. Wet, loose, Moderate yellowish brown.

— bottom contact appears to be dipping gently out of the hill

4.0 - Silty sand, poorly graded. Fine to coarse grained sand, primarily fine. 20-30% non to slightly plastic fines. Occasional cobbles, polished. May be more cobbles further down in the unit. Gravel to cobbles over 2". Estimate 10% gravel to cobbles. Moist to very wet firm to soft.

Not E/F

(78)

quickly dilatant. Moderate
yellowish brown.

ELEV. TOP OF SECTION

2274' @ 9° @ 65°

UNIT E, F

(2261')

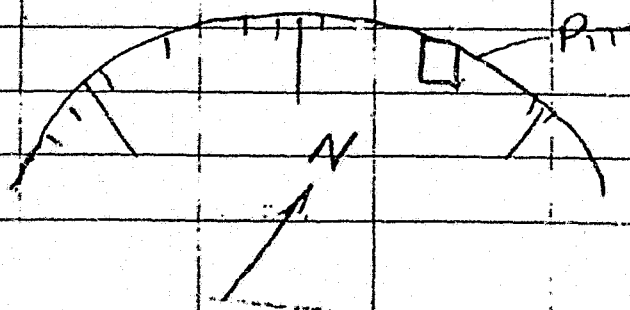
UNIT G

- seems to be some intertonguing
at the contact

Is a marked concentration of cobbles
to boulders beneath the vegetation
mat in the area. As we walk
gradually uphill (slight) &
downstream the outwash layer
is thickening

W-82-21

Arcuate exposure at top of drainage
break in slope with upper surface.
Center is oriented 185°



(79)

PIT #1

0.0 - 3.0' Vegetation mat, organics,
cobble / boulder layer

3.0' - 4.0' Sandy silt. Non to slightly
plastic, 30-40% fine grained
sand, moist, soft. Moderate
brown. Oxidized

4.0' - 5.3' Silty sand. Poorly graded
10-15% fines. Sand is fine to
coarse grained, primarily medium
Trace gravel ~ 10%, 1" - 3"
Gravel, subangular & some
subrounded. Moist, moderately
dense, brownish gray
Some thin dark brown organic
layers. Gradational contact

5.3' - 785' Gravelly sand, trace silt. Moist
moderate dense to dense. Fine to
coarse grained sand, primarily
medium. Gravel to cobbles up
to min. of 6", subangular to
rounded, mostly subrounded
Gravel comprises 30-40%. Partly to
poorly graded. Pale yellowish
brown.

ELEV. OF TOP 2298' @ 9.5° @ 64°

Picture of (2280')
K82-1-2 70' at break in
slope

OUTWASH - UNIT E & F

- the upper surface is flat with
white surface

- could cobble/boulder layer be remnant
of UNIT 'C' mixed w/ UNIT E/F?

W-82-22

Slump exposure bearing 160° @
25-30° slope. In steep fashion the
exposure is minimum 25-30' thick
mudflow.

Material is a gravelly siltier
clay, poorly graded, medium gray.
Gravel ranges from coarse sand to
cobble size, mostly gravel, subrounded
to subangular, 15-20%. Slight to
moderate plasticity, stiff, moist, low
cohesive. Some gravel, coarse sand
is polished and striations. Does not
seem to be overconsolidated. Probably
in Unit G, just further down in
the unit. See no stratification
indicative of waterlain. When it
becomes wet/very wet = mud flow

ELEV @ top of exposure

2231' @ 104° @ 640
(2208')

Sampled Gravel/cobble range
to 1' over 2' to 4"

K82-1-3 City of CL
Gravel 3"
Sand fines 17%
74%

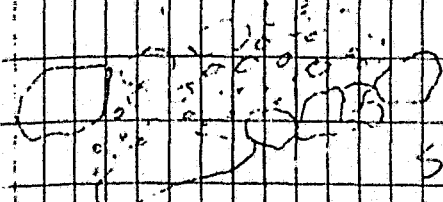
Further down slope exposure of the
same material, not to be confused. Think

ELEV. 2223 @ 11° @ 64° (2178)

We came further down slope than the
attrition indicating material

W-82-24

Sandy gravel displays graded
bedding. Bedding is about 3' thick
and is fine to coarse
E/F?



Strikes between 160° and
30° E-NE-W-NNW

Well graded. Percentage of gravel to
boulders 85-90%, 10-15% sand
Subangular to rounded mostly subrounded
Boulders up to 3' in diameter. Matrix
is a medium to coarse sand. Some

K82-1-4

(82)

fine grained sand and silty sand lenses
 Very, moderately ~~large~~ boulders are primarily
 granitic some metamorphic. Stands
 to a 15' vertical face. High
 energy environment deposited close
 to the glacier. Light yellowish gray
 fabric of slightly flat large boulders
 along S & d, Another S & d 180°
 35° east? west

ELEV. Base of vertical section
 2202' @ 1135° @ 64°
 (2174')

Going around the ridge, base of
 still exposed down to

W-82-25 2185' @ 1143° @ 64°
 (2157')

On the east-northeast face of this
 same exposure, the major ~~exposures~~
 always observed from the info. Have
 a sandy, gravel similar to ~~river~~.
 The graded bedding is not exposed.
 Have lenses of silty sand, ~~and~~
 cobbles and boulders - ~~and~~
 Estimated S & d 150° 15° SW

changed
 1143

(83)

Vertical cliff exposure 50 feet, in
 face to ~~the~~ slope ~~begin~~
 ELEV. 2220' @ 120° @ 64°
 (2190')

Have had ~~viewed~~ this H.M. out
 at approx 1145° S & d ~~in~~ ~~begin~~
~~viewed~~

Watawa 2210' @ 120° @ 64°

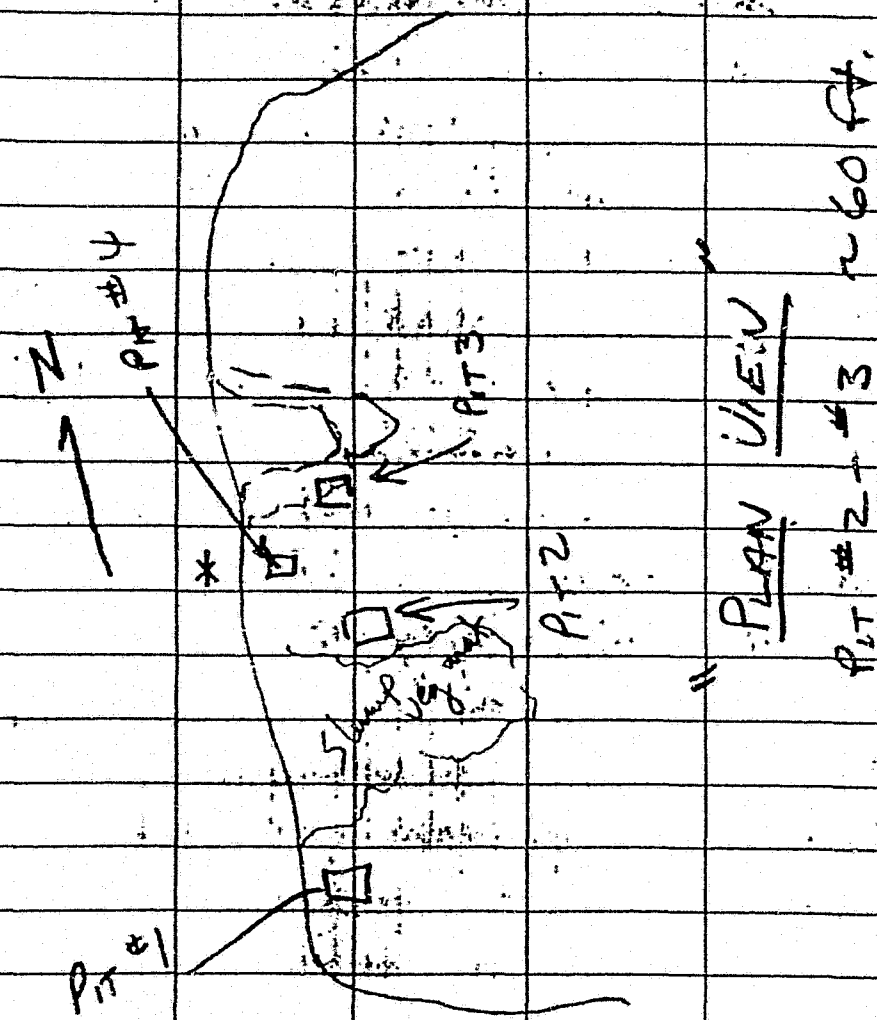
Upper surface above exposure is
 flat (2297')

ELEV. 2340' @ 215° @ 62°

Shump is adjacent to AH-9
 Compare the stratigraphy to.

W-82-26

Large exposure some ~~with~~
 boundary block 20' east and ~~is~~
 approx 200' across



Pit #1.

0.0 - 3.0' Covered by vegetation mat
Appears to be a gravel/cobble
zone in this segment.

3.0' - 5.7' Sandy silt, some
gravel and cobbles. Occasional
small lenses of medium to coarse
grained sand. Gravel is sub-
rounded and comprises roughly
10-15%. Poorly graded, moist,
soft to firm, slight plasticity.
Moderate yellowish brown.

5.7' - 7.0' Sand, fine to medium
grained, primarily medium grained.
Occasional gravel and cobbles ~ 10%,
subrounded, up to 4". Poorly
graded, uniform sand, moist,
moderately dense. Yellowish
brown.

OUTWASH Unit E & F

PIT #2

Contact between the overlying
outwash (unit E & F) and the
till (unit G). Will discuss the
materials on either side of the contact

ELEV. 2326' @ 2⁴⁷ @ 62°

roughly three feet (2279')

Above Contact - OUTWASH

Interlayered sequence of primarily
a moderate brown sandy silt with
gravel & cobbles up to 6" comprising
20%. The gravel is generally
subrounded. Moist, firm,
slight plasticity. Poorly graded.

Yellow brown fine to coarse grained
sands, primarily medium grained
partly to well graded. Moist,
loose.

BELOW the Contact - TILL

Medium gray gravelly silt-clay
with some sand. Wet, firm to
dense, moderate plasticity
poorly graded. Gravel to
cobble size comprise 30-40%.

most are subrounded, some are
striated. Occasional thin sand
lenses/layers primarily around
the gravel. Sharp contact

Appears to be a thin highly oxidized
zone w/i inches of the contact but
am unsure how continuous it is.

PIT #3

(2275')

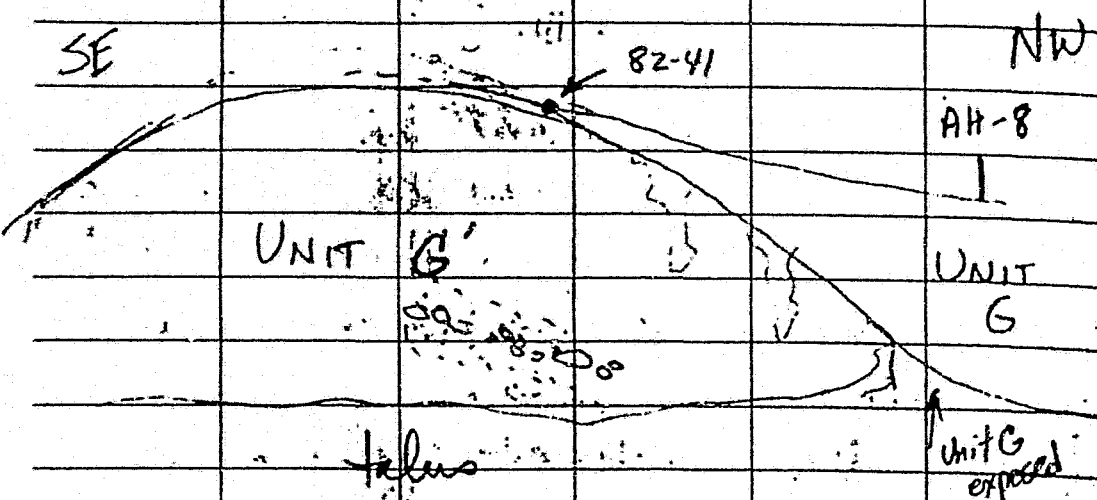
Contact at 2324' @ 3¹⁴ @ 62°

Same materials above & below as PIT #2
The contact is undulatory with minimum
exposed relief of 3'.

The outwash above is primarily
a medium grained sand with some
fine and coarse grained. Almost
no sandy silt here. Outwash appears
to be dipping to the SW, maybe on
edge of a channel in the till.
Sand is poorly graded, pretty uniform
20% gravel.
The till is much denser & maybe
overconsolidated w/i 8' lower than the

contact - Basal till here?

It appears that the high energy outwash adjacent to AH-8 is overlain by unit G indicating the this outwash is from UNIT G.



Some of the till, i.e. silty clay has flowed over the edge coating the vertical cliff.

W-82-27

Pit which intersects the upper surface
ELEV. T&A 2389' @ 445 @ 61°
(2338')

0.0 - 1.5' Organics

1.5' - 6.2' Sand, fine to coarse grained sand, primarily medium grained, some gravel. Down to 4.4' the material is oxidized. It is reddish brown, damp, loose to very dense, well graded, < 5% fines. From 4.4' to 6.2' the material is very dense, seems to be almost partly consolidated. Higher percentage of gravel estimate 30%, dry. Upper section has 10% gravel. Gravel are subrounded to subangular.

6.2' - > 7.0' Sand, moderate brown. Has fine to coarse grained, primarily medium grained. Uniform sand, only occasional gravel. Moist, dense well graded.

OUTWASH, UNIT C?

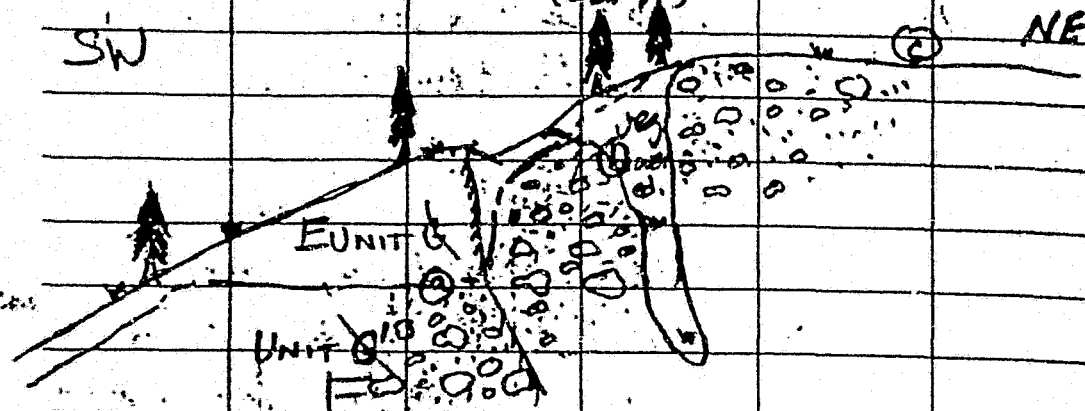
W-82-28

Upper surface

ELEV. 2387' $4^{\circ}55'$ (2327')(a) Contact at 2334' @ $4^{\circ}58'$ @ 62°
(2274')

SW

NE



UNIT G's Outwash beneath E

Light yellowish gray, gravelly sand, 90% gravel to boulders. Maximum size 3' to 4' in diameter sub-angular to subrounded. Doesn't appear to have graded bedding or cross beds. Fine to coarse grained sand with primarily medium grained sand. Dry dense, well graded, oxidized in places. Base of exposure, top of scree slope

ELEV. 2312' @ $5^{\circ}15'$ @ 63°

Where this unit thins out on the
(2288')

slope, in the upper few inches of this unit the aforementioned gravelly sand is interlayered with ~~gray~~ medium gray fine sand and clayey silt.

Going along slope to the NE, the gray till thins to just a cap. It is higher than or equal to

(b) ELEV. (2285')

2350' @ $5^{\circ}39'$ @ 62°

The majority of the slope is covered & I cannot get near the contact where it is thickest.

UNIT G E

Medium gray clay silt with some gravel and cobbles. Not really accessible here. Appears to pinch out as cap towards the NE. Maximum thickness appears to have been ~6'-8'.

(c) ELEV.

2392 @ $6^{\circ}25'$ @ 60°

(2325)

Watana 2329' @ $6^{\circ}30'$ @ 60°

7-22-82

It's a cloudy overcast morning raining slightly. Will continue to work on the west side of Deadman Creek.

Bear cited below us upon arrival at Deadman, will not work on the slopes below the crest for safety reasons.

Wastana ... 2260' @ 5⁴³ @

W-82-29

Moderate brown sandy gravel, 80-90% gravel. Gravel to boulder size up to 5-6' in diam. Fine to coarse grained sand matrix, primarily medium grained. Dry, moderately dense, well graded. No other material.

ELEV. TOP

2297' @ 7⁴⁵ @ (2292')

ontop (ie Unit G) Exposure is ~ 60' high.

OUTWASH

UNIT G

W-82-30

Moderate brown gravelly sand fine to coarse grained matrix, primarily medium grained. Gravel comprises 40% subrounded, up to 3' diam. Dry to moist, loose, moderately compact, well graded.

Boulder zone along the surface

OUTWASH

UNIT EFF

W-82-31

Moderate yellow brown sandy gravel three foot layer exposed at the surface. Slight iron staining of boulders. Boulders up to 4' in diameter. Medium to coarse grained sand matrix, some fine grained sand. Dry, moderately compact well graded. Boulders are subrounded.

OUTWASH

UNIT C - probably the boulders are a remnant of, fines have been

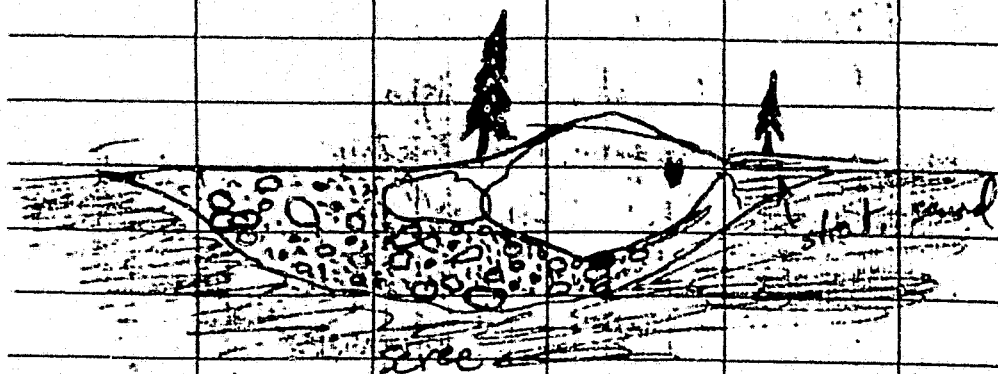
ELEV. TOP

2293' @ 8⁴⁴ @ 55°

washed away.

(2282')

W-82-32



Gray, sandy gravel. Approx 85% gravel to boulders, up to 12' across, subrounded to rounded. Silt to coarse sand, over silt to fine sand, which is very dry and has cemented the matrix. Compact, partly sorted.

not definitive { Appears the channel was flowing out of the hill; laminated fine sand, uniform on edge of channel, rusty brown, compact, dry.

Exposure is roughly 35' across.

Some thin laminated layers beneath some large boulders.

UNIT D Channel Filling

Waters

2243 @ 5⁰⁰ @ 48⁰⁰

In most of the boulders adjacent to Deadman Creek Unit G was encountered within the upper 15'. A possible explanation for the stratigraphy in Deadman Creek is the following;

- at the time that the meltout or waterlain till was deposited a large subglacial channel existed. Based on the size of the boulders in the sand & gravel / outwash exposure deposition occurred very close to the ice margin at roughly the same time the till was being deposited. It appears that Deadman Creek roughly follows the old channel which is filled with outwash.

(96)

W-82-33

Cobble to boulder size material exposed as a talus/scree slope. It appears that bedrock is probably close to the surface on this slope.

The slope is not active, as evidenced by the lichens cover. Will get an approximate elevation from the helicopter.

Watanabe

2260' @ 25° E 34°

W-82-29

Cross bedding is visible in the SE portion of this exposure. Appears to dip ~ 25-30° to the SSE.

(97)

W-82-34

Large exposure oriented 140°. Appears to be a couple of units here but much of it is suspect due to slumping.

~ 12' from surface

Beneath a 4' diam. boulder

is a 2" medium gray silty clay.

Moist, soft, cohesive, non plastic

- 1"-2" highly oxidized hematitic, rusty red fine to medium grained sand layer. Dry, loose, uniform poorly graded.

fell from above

Beneath which is a sequence clayey-silt to medium grained sand uniform layers/lenses up to 2" thick.

- Sand layers are medium grained yellowish brown, moist, loose,

- fine sand to clayey silt layers are a light moderate brown soft, moist to wet. Clayey silt is plastic.

ELEV. TOP - flat surface

2247' @ 3⁵⁵ @ 58° (2239')

Polaroid & Photo #79 subrounded

0.0 - 1.4' ORGNICS. Boulders up to 3'

1.4' - 2.5' White-gray fine to medium grained, uniform sand, trace silt, 25% (?) Moist, moderate

F/F? may be dense, well sorted. Some

(1) organics within. Boulders on surface extend down into this

layer. At base of there is a thin ~1/4" dark olive gray clay layer. Moist, firm, plastic. Clay layer is wavy.

2.5' - 2.7' Yellowish brown sand.

Well sorted. Some is white-gray.

Fine grained sand, moist, moderate dense.

(2) - at bottom is a 1/4" - 1/2" medium gray clayey silt w/ trace sand. Moist, firm-soft, plastic.

2.7' - 4.3' Rustic red to yellow orange sandy silt to sandy gravel.

(3) Hematitic. Layers of sand & sandy gravel

- sandy gravel, ~ 80% co. sand to gravel, subrounded to rounded. Fine to medium grained sand matrix, moist, loose, moderately compact, partly sorted.

- sand - medium to fine gravel, some coarse sand. Moist, loose, well sorted.

4.3' - 5.7' Yellow brown gravelly sand. Approx 40% gravel, subrounded up to 18", generally < 3".

Graded bedding, gets coarser with depth. Moist, loose, moderate compactness. Well graded. Some medium grained sand lenses/layers at top of unit. Cross bedding.

@ 6.0' large boulders up to 2' across. This starts as a fine grained sand & grades downward to a medium to coarse grained sand.

Farther down in the slope, it appears that Unit G may crop out but it is in the slump zone. The base of the slope does flatten out.

SE

NW

UNIT G



Approx. 10' over from the site description drop stones are evident, up to 3.5' across. See polaroid pic, Photo #20. Material appears to have flowed S-SW (210°)

Closer to the creek (NE) the hematitic layer and the gravelly sand layer are fine to medium grained sands with some cobbles.

Layers are wavy difficult to find the most common orientation in this stratified deposit.

The boulders covered by the tundra or not increase in % drastically from the flat upper surface above the last outcrop. In walking to the east up onto the hummocky ice distintegration surface to the east.

10-82-35

Within a couple of feet of the top knob/ridge. (2358')

ELEV. 2378' @ 6° @ 55°

Excavated a two foot deep pit with backhoe #1. Material is a light to moderate brown gravelly sand. Matrix is a fine to coarse grained sand, primarily fine grained. Has some gravel and cobbles, estimate 10-15%, subrounded to angular, mostly subrounded. Moist loose, poorly graded. Material doesn't appear to be stratified but it's difficult to tell.

Sampled Polaroid Pic - didn't come out very well.

Gravelly sand	SM	16% Gravel
		68% Sand
		16% fines

Waters 2282' @ 6° @ 50°

TRIED USING the Polaroid CAMERA, didn't work very well from the chopper. Took slides of 4 or 5 exposures. Bear was seen beneath T.D. #1 this morning, as a consequence some exposures were skipped.

7-23-82

Dense fog covers the site area.
Choppers can't get out this morning.
Rained hard last night. Will work in
the office.

7-24-82

It rained most of the night. It
is cloudy & overcast with a ceiling at
about 3,500 ft. Will pretty much
finish up surficial right in Deadman
Creek.

Watana 2260' @ 6⁵⁵ @ 44°

W-82-36

Relatively flat upper surface with
a good exposure in the upper few feet

ELEV. TOP
2268' @ 8²⁵ @ 54°
of the slope. (2263')

0.0 - 1.0' Organics

1.0' - >4.5' Gravelly-sand. Gravel
ranges up to boulder size, but
generally coarse gravel to cobble
size. Average size is 2" to 3"
but up to 2' in diameter.
Averages roughly 40% Sand

is fine to coarse grained but primarily medium grained. White gray, moist, loose, poorly graded. Gravel is mostly subrounded with some subangular and trace amounts of angular. At the top there appears to be a gray silt layer in places similar to that seen in 82-34. It seems to pinch out in places. Not sure if its at the bottom of the organics layer or in the top of the gravelly sand.

- the larger boulders appear to be concentrated at the top

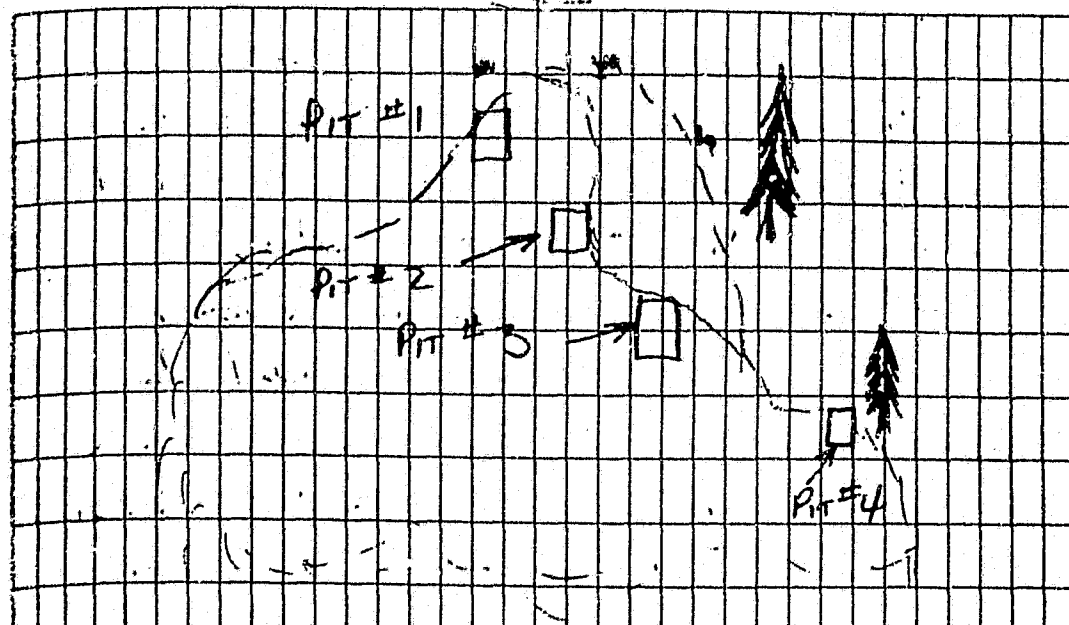
ALLUVIUM or ALLUVIUM (reworked Qu)

10-82-37

Exposure produced by upper 6" of soil & vegetation mat flowing downslope.

Oriented 255° and slopes $30^\circ-35^\circ$.

Took a polaroid picture of PIT #2



PIT #1 (2254')

Elev. 2263' @ 94° @ 58° (top)

Two feet high. Approx 6' below the vegetation.

Sand, fine grained, trace to some silt. Uniform, moist, moderately dense. Stratified. Light moderate brown.

PIT #2 (2250.5')

Top of PIT #2 is 3.5' below the top of PIT #1. At 4.0' below top of PIT #1 the sorted sand which continues in this pit is thinly layered.

Tan fine grained sand layers
intercalated with a light brown
silty-sand layers roughly $\frac{1}{4}$ " thick
Strike 280° Dip $9^\circ N$. (a)

At 4.8' is a continuous oxidized
layer of fine grained sand with
thin layers ($\frac{1}{8}$ " - $\frac{1}{4}$ ") of medium
gray clay which is moist & slightly
plastic (b). The adjacent thin oxidized
layer is ~~not~~ part hard & compact.
Beneath this the uniform sand
continues to 6.0'. Sampled (c)

(b) 298° $14^\circ N$ Sandy-silt (?) HL
6.0' - 9.0' Light to medium gray
silty sand with some gravel.
45% Sand 55% fine

(c) Moist to wet, compact, moderate
dense. Sand is primarily fine
grained (?) with some medium
and coarse grained, poorly
graded. Gravel is $\approx 20\%$,
subrounded.

Sampled (c) Gravelly, silty sand SM
20% Gravel
Compare the two samples 51% Sand 25% silt fine

UNIT D or E/F

W-82-38

contact between light moderate brown
gravelly sand and the medium gray
lacustrine or waterlain H/I

ELEV. of contact

2234' @ 11° @ 58°

UNIT G contains $\approx 10\%$ gravel
(2218')

everything else is the same as
82-12, only 120' N of

ELEV. Upper Surface

2255' @ 12° @ 58°

(2239')

W-82-39

Mudflow slope exposure, fairly
steep. Orientation 295° on a 30° - 35°
slope. Top of exposure is roughly
 $\frac{1}{2}$ way downslope. Light gray mostly
some moderate yellow brown. Gravelly
sand, fine to coarse grained, primarily
medium grained. Less than 5% fine

Moist to wet (at the surface) loose, moderately
poorly sorted. Gravel is up to cobbles size
6", subrounded, over is 2".

Could this be reworked till, Unit G?

ELEV - Top of exposure
2176' @ 12⁵⁰ @ 60°
(2157')

At the break in slope, edge of upper surface the material is a light gray fine grained sand with some coarse sand to gravel partly to well sorted. Moist, loose, moderately compact. Some silt in the upper part.

ELEV. TOP
2246' @ 1⁰⁰ @ 58°
(2226')

Brief help record for some basic notes

W-82-40

2140' Med gray some cobbles to boulders

W-82-41

Part AH-8 and almost to the high point of the sand & gravel deposit. 82-25

Elev 2259' @ 1⁴⁷ @ 58°
(2237')

Organic

0.0 - 0.5 A Sand, some gravel fine to coarse grained primarily fine to medium. Moist, loose, light brown (tan).

0.5 - Med gray, sandy clay with some gravel to cobbles. Moist, soft, plastic. Some thin sand lenses. Gravel is

20% to subrounded up to 6" generally 2-3". Sand fine to medium grained & compresses roughly 10-20%.

Difficult to tell if clasts are striated w/o cleaning them. Sampled. Picture

- was unable to see the bottom contact of G with G' as this occurs at the break in slope. Shrimping is occurring in Unit G above the sandy gravel unit.

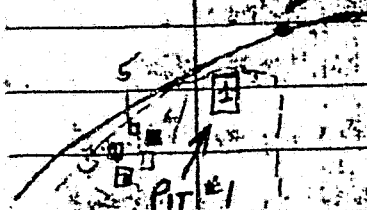
Sandy clay or silty clay CL-CH 15% Sand
28% Sand
62% fines

Stopped by Rig #2 hole #16

Observed the dense to very dense, lacustrine clay, which is laminated

Took picture of contact @ 82-26
at Rig #2

Elev. 2194' @ 3³² @ ~ 58°
(2166')



W-82-42

Pit #1

0.0-1.0' Organics, vegetation mat

1.0-2.2 Light moderate brown

silty sand with some gravel to

cobbles. Moist, moderately

dense, poorly graded. Gravel

is subrounded to subangular and

comprises 10-20%, the max.

size is ~1'. Non plastic fines

2.2 to 6.5' Light moderate brown

to light brown sand with

some gravel and a trace of

silt. Primarily a fine grained

UNIT
E/F

gravel
silty sand

sand with some medium grained

Gravel to cobbles are subangular to

subrounded, up to 4", and comprise

roughly 10-15%. Material is moist,

moderately dense, compact

The gravelly sand encountered in Pit #

continues with depth. At (b) the gravel

comprises roughly 20%, the sand matrix

is fine to medium grained. It is either

(2131')

(b) Elev. 2162' @ 4³⁶ @ ~ 58°

interlayered with (a) contains pockets

of a material resembling a till. The

is a light to medium gray gravelly,

silty sand. It is dry, compact

nonplastic, poorly graded.

At roughly 2' below (b) the

material is a medium gray gravelly

silty sand with a trace of clay.

The gravel to cobble size comprises

20-25%. They are subangular to sub-

rounded. It is moist, compact, moderate

dense, nonplastic, poorly sorted. There

are possibly some thin sand seams

layers.

UNIT
G?

W-82-43

An exposure roughly 15' high and 35' off and on again across. The entire exposure roughly 15'-20' is composed of a sandy gravel with layers of silty sand. The gravel ranges up to boulders, generally less than 15' across with much of it in the 2" to 4" range. The gravel comprises 80-85%. The sand ranges from fine to coarse grained, primarily medium. It is a light moderate brown to a light moderate yellow brown. The finer grained layers which it is interstratified with is a medium gray silty sand. It is moist, non to slightly plastic, moderate dense. The sandy gravel is moist, loose moderately compact. The gravel is subrounded and subangular most are elongate and some are striated.

Bottom of good exposure is

Elev. 2176' @ 5²⁶ @ 57°

Material ^(2142') is exposed for roughly 15' above w/ the flat upper surface at least 20' above.

Layer appears to strike 350° and dip 5° w/ the elongated cobbles strike 270° and dip to the west. - This aforementioned layer was a cobble/boulder zone.

W-82-44

Stamp exposure 1075° 35° S

A light moderate brown with some gray, gravelly sand. Gravel comprises 25% mainly as cobbles and boulders. They are subrounded to rounded and average 4" and 8". The matrix is primarily a fine sand with a trace of silt. It is moist, loose moderate dense, poorly graded. Occasional coarse sand grains.

Elev. (2126)

2161' @ 5²⁴ @ 57°

elevation is 5' below veg mat

Break in slope (2070')

ELEV. 2106' @ 5° @ 55°
should be till along the exposures
at the break in slope or just above

W 82-45 (2079') top

At elevation 2115' @ 6° @ 55°
the medium gray gravelly silty clay
is exposed in up to an 8' section.

6 The gravel comprises up to 15-20%
they are subangular, up to 8" in diameter, average is
probably in the 1" to 3" range. Many
of the clasts at the base of the exposure are striated & some are polished. The matrix is soft, moist, cohesive, slightly plastic & crumbly (in outcrop and on the shovel). Material is flowing out from the base of the hill.

ESTIMATE the actual contact is $\pm 15'$
above elev. 2115' @ 6° ($\approx 2094'$)

ELEV. upper surface

2231' @ 6.5° @ 55°
(2194')

Watana:

2298' @ 6.3° @ 52°

At AP-3 the TILL, UNIT G was encountered at $\sim 14'$, $\sim 2265'$. Therefore after reducing the altimeter data, it appears the unit G dips towards the river.

UNIT G
The sand & gravel at 82-44 is definitely overlapped by the gray till, UNIT G.

7-25-82

It's been raining continuously since 5⁴⁵ AM yesterday. Also it's very foggy out. It's a carbon copy of Friday morning.

7-26-82

It's mostly cloudy this morning with a ceiling of roughly 5,000'. Appears to be clear over in the Copper River Basin. Will continue downslope from where I ended Sat, downslope of AH-3, AH-D16.

Wataana 2260' @ 6⁴⁵ @ 40°

W-82-46

Bedrock outcrops at the surface on either of this gully/chute

Elev. 1948' @ 7²⁸ @ 49°
(1949')

Competent rock exists on the downstream side of the gully, forms a very high steep cliff with a high pt. of 10'-25' higher than the altimeter reading. In the gully itself and on the upstream side the rock is not continuously exposed. The rock is generally highly fractured & moderately weathered and is probably sheared.

Much of the rock is disintegrated along its grain boundaries & contributes to the talus slope (soil & rock in the upper section). Much of the rock here is incompetent.

The rock is a gray to light gray medium grained, biotite rich diorite. The diorite is slightly oxidized. mafics comprise roughly 25%.

The gully forks at the top and one of the following orientations on both probably closely coincide with the fracture &/or shear zones.

- (a) 290° ← looks like this one is a good bet
(b) 340°

JOINTS

- (1) * 308° 86° SW
 21° 63° SE plane, smooth
 { 327° 335° 88° NE curved, smooth
 6" & 1-2" inches to 2'
 { 325° 79° NE
 { 340° 75° NE
 (2) * 295° 54° S curved, smooth

* 52° 48° - 55° NW
 ? plane rough
 65° 25° NW
 52° 47° NW plane smooth, inches to 1'

In the gully a yellow orange clay gouge is exposed but only on the road slope unless interested in this area it is not appropriate to spend any more time delineating the definite orientation of the shears.

May be a small xenolith of argillite near the top of the gully.

W-82-47

Mudflow exposure on a slope 93° sloping 15° - 20° . Mudflows cover an area of $100' \times 60'$, numerous downed trees. Very wet here due to surface drainage.

ELEV.

(1923')

1920' @ 9° @ 54°

gravelly,

Material is a medium gray sandy clay to primarily (?) gravelly sand silt (lasts up to 10'), generally subrounded

Material is flowing out from beneath the vegetation mat & it is impossible to find an undisturbed area. Believe it is undoubtedly the till in UNIT G.

W-82-48

Bedrock exposure

(1820)

1816 @ 9.43 @ 56°

Am at the base of the rock cliff with the top of the cliff approx. 150' higher. At the base of the exposure is an inactive talus/scree slope which is covered by moss & birch trees.

Rock is the light gray, medium grained diorite. Matrix comprise ~ 25% & consist of biotite & hornblende. Rock is hard, massive & competent.

JOINTS:

295°

73° SW plane, rough 6" to 2'

53°

52° SE, plane, smooth

12°

40° W plane, smooth

1' to 3.5' aver. 2'

W-82-49

In the creek emptying this small drainage is an exposure of bedrock on ELEV. 1753' @ 10.22 @ 60° both sides of the creek (1757')

Rock is a dark gray, fine grained argillite. Hard, broken up, highly fractured zone. Generally, the outcrop will break up into pieces $\leq 1'$.

The soil exposure on the west side of the creek is a dark yellowish brown (gravelly) silty clay with some sand.

Wet, soft, moderate plasticity, cohesive. Gravel up to cobbles ($\sim 5''$) angular and comprise ~ 50%.

Exposure on west side is 15' x 30'. Will get joint measurements from exposure at creek level, on east side, ~

The east side exposure is 10' x 50'. It is highly fractured much like the other side of the creek. It is still the dark gray, fine grained argillite. It appears that the rock has been baked, i.e. likely if it is a xenolith within the intrusive body. It is impossible to get any accurate readings on the jointing or bedding(?).

appears to be some recrystallization

Weathered surface is a dark yellowish brown to a moderate yellowish brown (similar to mafic dikes at D.C.)

W-82-50

At a rock exposure approximately 10' above the river. It is 20' x 40' and a talus/screed slope extends from the base to the river. The outcrop is very highly fractured with pieces no larger than 6". The rock

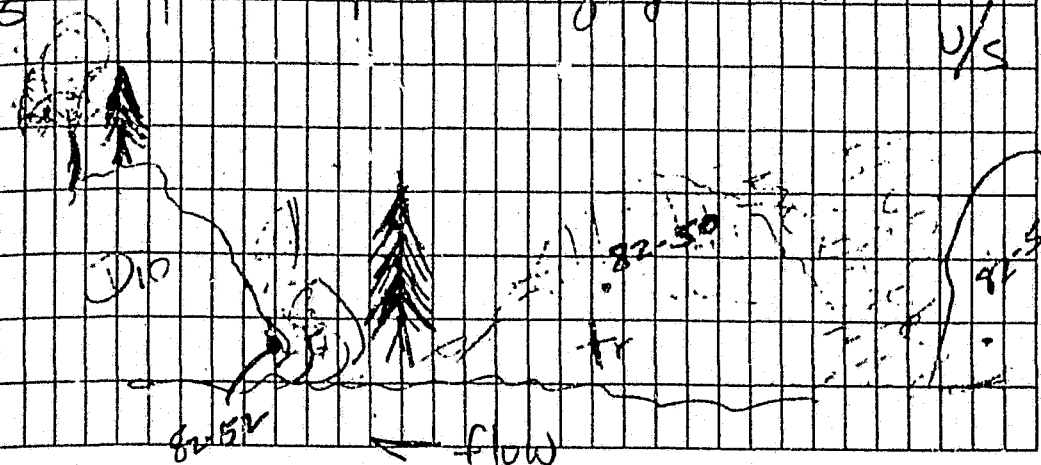
is a light gray, fine to very fine grained felsic rock. Sampled. Heavy iron staining which has penetrated the rock. Roughly 5-10% mafic. Very angular pieces. Concordant fracturing / scalloping occurs in the rock. Incomplete rock exposure. This outcrop could possibly be a dike.

W-82-51

Continue upstream for 75' is another bedrock exposure. The exposure is of hard, massive, & competent rock. It's a medium green gray, medium grained diorite which is biotite rich. Mafics comprise roughly 30%.

D/S

U/S



(124)

JOINTS:

37° 59° SE plane smooth
3" to 3' aver. 1'

314° 54° NE plane, smooth
1' to 2.5'

290° 49° S plane, rough
1' to 2'

OUTCROP is 25' x 75'

- end is ~ 200' W/s of creek
confluence

W-82-52

Tall outcrop of light to medium
gray, medium grained, diorite. Biotite
is the chief mafic mineral. Hard
massive, competent. Was here in
1980.

JOINTS:

* 330° 71° NE plane, smooth
1" to 2'

* { 80° 70° S plane, smooth
6" to 2.5'

{ 265° 54° S plane, smooth
88° 63° N " "

(125)

355° 55° W plane, rough
1' to 3'

Watawa

2252' @ 126° @ 59°

Began a traverse along the north abutment
from just E/s of Deadman at the start of the
bedrock cliff to the "fins". Will get elevations
of bedrock exposed, highest topographic
exposure.

W-82-53a

On a ridge that trends west towards
the river at 175°. (1967')

Elev. 1962' @ 237° @ 65°

A ridge adjacent to the gully visited
first thing this morning, 82-46
Green-gray, medium grained diorite, biotite
is chief mafic mineral

(b)

(1960')

F156 @ 250° @ 65°

U-52.54 (C)

Near the very nose of this cliff
the gully adjacent to this point on the
upstream side has no bedrock exposed
in its center (1915') just above

ELEV. 1913' @ $3\frac{1}{2}^\circ$ @ 64°

Light gray medium grained diorite,
biotite rich with some gray-green, primarily
fine grained porphyritic diorite (Diorite
PORPHYRY).

The medium grained diorite has
25-30% mafic content. the Diorite
Porphyry has fine, medium grained biotite
and appears to have only 10-15%.

JOINTS:

330° 79° NE

351° 43° W

83° 59° S

(1897')

(d) 1897' @ $4\frac{1}{2}^\circ$ @ 64°

- on the nose of another bedrock
ridge

- light gray, medium grained
diorite, biotite rich

(e) (1935')

1936' @ $4\frac{30}{60}^\circ$ @ 65°

- on top of a ridge, bedrock
exposed at least to this height

(1969')

(f) 971' @ $4\frac{50}{60}^\circ$ @ 62°

Rock is the light gray, medium
grained diorite, biotite rich.

(1963')

(g) 965' @ $5\frac{20}{60}^\circ$ @ 62°

- bedrock is probably just
beneath the surface as much
as 20' higher in elevation

(h) 2020' @ $5\frac{23}{60}^\circ$ @ 62°
(2017')

(128)

(2024')

i. 2027' @ 5³¹ @ 64°

Bedrock exposed on the east side of this SE/NW trending ridge. The rock is still the light gray, medium grained diorite, biotite rich - the gully which now just crosses did not have any bedrock exposed in the very upper section although the slope was quite steep and probably indicative of bedrock close to the surface.

(1948')

j. 1952' @ 5⁴⁴ @ 64°

bedrock is probably just beneath the vegetation mat in walking down this ridge, but this is based on exposed rock

(129)

W-82-55 (K)

OUTCROP OF light gray medium to coarse grained diorite, biotite rich.

ELEV. (1915')

1920' @ 5³⁶ @ 64°JOINTS:

355° 60° E plane, smooth

322° 58° SW plane, rough

j. 1839' @ 6¹³ @ 63°
(1833')

W-82-56 (1906')

M. 1912' @ 6²⁴ @ 63°

light gray, medium grained diorite biotite rich. Some hornblende? Mafics comprise roughly 25%

JOINTS:

282° 75° N plane, smooth

332° 54° NE irregular, smooth to rough

312° 56° SW plane, rough

16° 20° W irregular, rough
some medium-gray aphanitic material
with fragments of diorite. On one
side of this irregular shaped intrusion
the mafic minerals in the diorite
are aligned in a flow structure.

Watana

2277' @ 73° @ 52°

The above positions starting with
W-82-53, @ are on the 1"=400'
topographic map. Generally the
diorite was hard & competent. It should
be mentioned that the highest point
of bedrock exposure in the gullies
was not determined. Also it is likely
the rock is of a lesser quality in the
gullies.

7-27-82

It's mostly cloudy this morning
with a ceiling at 4500'. Will work
over near the Falls working with the
top of the bedrock exposure. Later in
the day, will move to Tsubana Creek
and work on surficial geology upstream
of the Falls. Appears to be clear over in
the Copper River Basin.

Watana 2260' @ 65° @ 45°

Am continuing a traverse in the
downstream direction towards the Falls
for the purpose of delineating the highest
elevation at which bedrock is exposed. Will
be difficult here because of dense vegetation

(in) (1809')

1809' @ 74° @ 56°

in walking down to this point
it appears that bedrock continues
upslope beneath the vegetation

(132)

mat.

(1800')

(O.)

1800' @ 8⁰⁰ @ 35°

- small bedrock exposures around the nose of this ridge at approx. this elevation.

(P.)

1838' @ 8¹⁹ @ 35°

- small bedrock exposures, cinder

(1837')

(1909')

(Q.)

1910' @ 8³⁰ @ 55°

- walking up the west side: this ridge is bedrock exposures of 2'-10' high. Probably continues up higher, will investigate on the return leg.
- lots of talus, vegetation cover adjacent to the ridge $\approx$ 100' wide, west side

(1864')

(R.)

1865' @ 8⁴² @ 55°

- small bedrock exposures medium grained, light gray, quartz with biotite as the chief mafic

(133)

mineral

CI = 25%

W-82-5' (3)

Small easily oriented - 135° at this point. Good bedrock exposures especially on the NE facing slope. Bedrock on that side is exposed for another 20'-30' higher.

1984' @ 9¹³ (1983')

light gray, medium grained, quartz biotite & talus. CI - 20-25%. Hard, massive, competent. Trend of outcrop exposure is 322°, exposure is > 100' long.

JOINTS:

1-3'	43°	52° NW	plane, rough	several feet
	45°	18° NW	plane, rough	
1-2' minimum	328°	79° NE	plane, rough	several feet
	64°	45° SE	plane, smooth	
		1'-2' minimum	most	
			quartz	
	48°	68° NW	plane, smooth	
		7'		

(2055')

T. 2057' @ 9⁵² @ 61° F

- small bedrock outcrops scattered all over this slope, numerous boulders exposed near the surface bedrock is close to the surface in this general area

- WILL WALK BACK UPSTREAM TO SEE IF THERE IS ANY BEDROCK EXPOSED HIGHER UP ESPECIALLY FARTHER OVER.

(2024')

(u) 2026' @ 10²¹ @ 60°

Bedrock cliff is about 25' higher
Diorite pronounced jointing along

325° 55° NE plane
smooth 6"-2'

(v) 1967' @ 10³⁴ @ 60°

Diorite outcrop - large.
(1965')

(1935')

(w) 1937' @ 11²⁰ @ 60°

Bedrock exposed 10' x 30'

If a buried channel does have an outlet or inlet in this area it is between 9 & 11. Much of the slope (>50%) between these two points is steep in the 1650' - 1975' range somewhere. I get the feeling that bedrock is close to the surface

This would indicate that a steep gradient in the channel is necessary from here to DR-22. In addition with the buried channel entering the present Susitna the buried channel has to almost turn a corner, no matter which way the Susitna was flowing.

Boulder stream highest visible point 2184' @ 11³² @ 60°

Minimum 100' wide x 500' - 800' long
(2182')

DRAW UP A X-SECTION OF "FINS"
 AREA to DR-22 w/ seismic line
 elevations & data gathered the last two days
 Watana 2262' @ 11⁵⁵ @ 58

Heading for Tsuena Creek.

W-82-58

New mudflow exposure, at least
 since 1980. Approx 100' long, 20'
 wide. Oriented 135° on a 15°-20° slope.
 Gravelly, clayey silt with some
 sand.

ELEV. TOP (2058')

2071' @ 1²³ @ 62°

Gravel to cobbles primarily with an
 occasional boulder. Generally the clasts
 are subrounded, elongate. Some clasts
 are striated. Gravel comprises 20%
 Sand comprises 10%. The material
 is moist to wet, non to slightly plastic,
 if firm, cohesive. Dark yellowish-brown.
 Breaks in small chunks. Poorly graded.
 UNIT G, Till

Bedrock above waterfall is
 2015' @ 2¹¹ @ 60°
 (1995')

W-82-59

Dark grayish brown gravelly,
 silt clay with some sand. Gravel
 and cobbles comprise 20-25%, generally
 they are subrounded; many are polished
 and only a few are striated. (2134')

2156' @ 2¹¹ @ 60° top of

the matrix which is a silt-clay
 contains approx 10% sand. It is moist,
 soft to firm, plastic, poorly graded,
 cohesive.

UNIT G, Till

Oriented 83° on a slope of 33°.
 Some clasts are polished, only a few are
 striated.

(138)

W-82-60

@ TOP OF SLOPE

ELEV. 2297 @ 3^{30} @ 63°
(2269')

⑤

⑧

(139)

⑥ 2253' @ 3^{42} @ 63°
(2223')

PIT # 1

- just ~10' below elev. ⑥

Material is a gravelly, sandy-clay
Gravel to cobble size, occasional boulders,
comprises 25%, primarily subrounded,
many clasts are striated. Sand
comprises roughly 20%. Moist to wet,
moderate plasticity, soft, poorly graded
Dark yellowish brown.

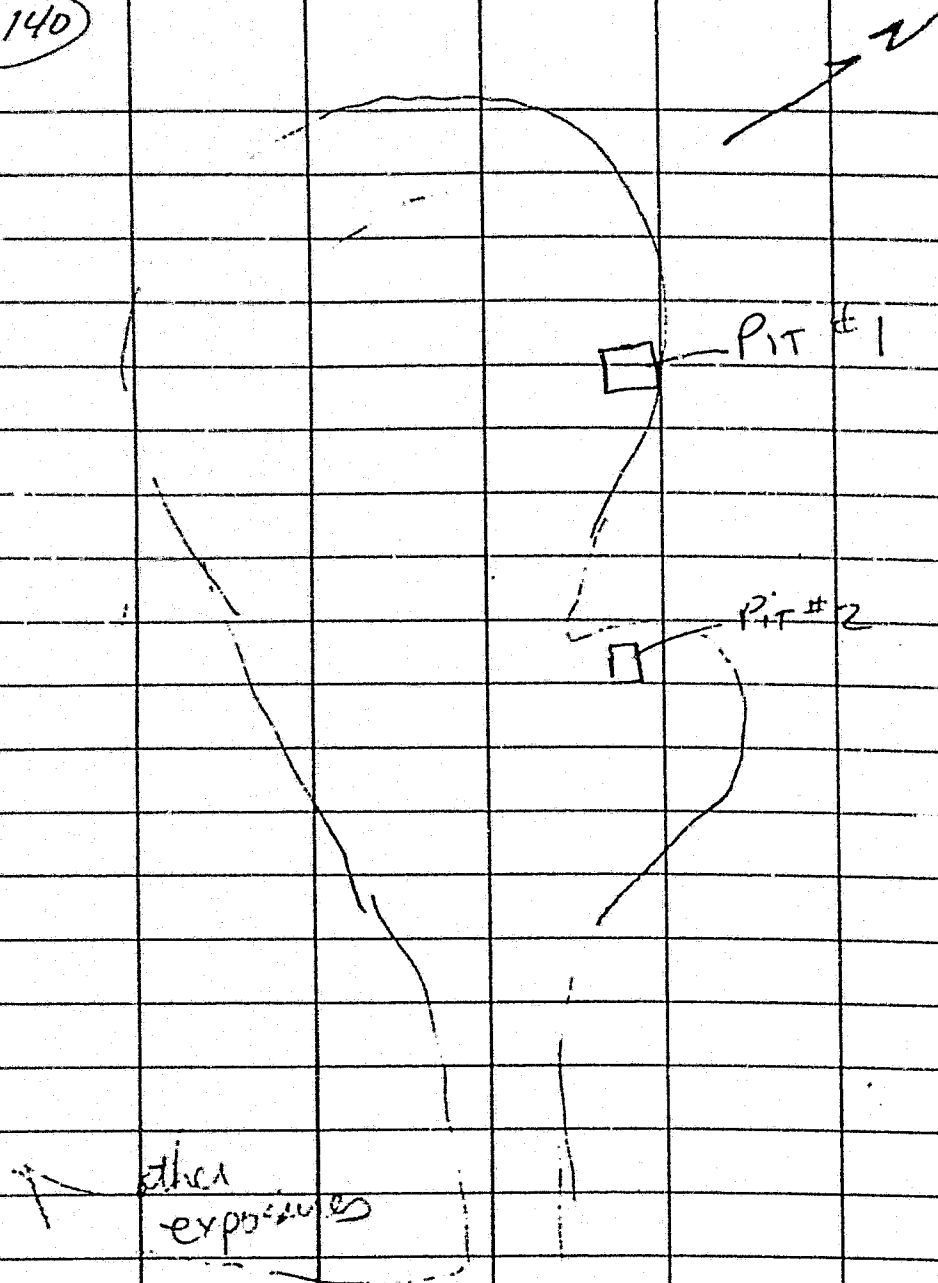
Large mudflow has produced this
exposure. It is oriented 120° and
slopes at 11° .

TILL - UNIT G

PIT # 2 (2172')

2205' @ $4''$ @ 63°

TILL - UNIT G is a medium
gray gravelly, sandy-clay. All
the same properties except it is soft to
firm.



PIT # 3

Fill - dark yellowish brown
gravelly, sandy clay. Sand
content may be increasing slightly.

ELEV at bottom of exposure

2126' @ 43° @ 43°

UNIT G (2089')

Watana,

2305'

545

7-28-82

It's a beautiful sunny day, only our third. Will work on surficial mapping on the west side of Tsusena Creek.

Watana 2260' @ 6³⁷ @ 52°

W-82-61

Exposure oriented 150° on a 25% slope, has a ~20' vertical exposure. Material is primarily a sandy, gravel. Appears to be a cobble rhyolite zone.

ELEV. TOP OF EXPOSURE

2130' @ 735 @ 58° (2124')

with an orientation of 280° - 32°S

0.0 - 1.0' Vegetation mat, organic

1.0' - 2.7' Dark yellow brown, ^{gravelly} silty sand trace clay. Very wet, soft, poorly graded. Gravel is generally

subrounded, comprises 30%. Sand is fine to medium grained.

- material is somewhat suspect in thickness because it is flowing downslope beneath the vegetation mat.

2.7' - ~6.0' Dark yellow brown gravelly sand. Gravel comprises 35-40%, generally subrounded. Moist, moderate dense, slightly compact. Fine to coarse grained sand, primarily a medium grained sand. Less than 5% fines.

~6.0' - Dark yellow brown, sandy gravel. Gravel is generally subrounded, some is rounded. Gravel ranges to boulder size, primarily in the cobble range, comprises 65-70%. Less than 5% fines. Medium to coarse grained sand matrix, primarily medium grained. Orientation was gotten from this sample. Average size of cobbles is 4" - 6".

DOTWASH UNIT E/F

W-82-62

1. exposed more in time than the previous one. Exposure is oriented

ELEV TOP. (2071')

'2105 @ 82° @ 58°

285° on the north side of a steep ridge.

0.0-0.6' Organics

0.6'-2.4' Gravelly sand: Gravel comprises 25%, subrounded with some subangular. Damp, moderate dense, poorly graded. Primarily fine grained sand, trace silt.

Matrix is fairly uniform. Light to Moderate yellow brown

2.4'-6.2' Sand. Fine to medium grained sand, trace silt. Fairly uniform sand. Damp, moderate dense, well graded. Material is stratified, X-bedding(?). Moderate

165° 24° W

yellowish brown

-5.1' is a dusky brown organic layer

6.2'-

Sandy gravel. Gravel & some pebbles comprise 40%, subangular to rounded, primarily sub-rounded. Fine to coarse grained sand, primarily medium grained. Moist, moderate dense, poorly to partly graded. Material has a minimum thickness of 10'.

Moderate yellow brown

OUTWASH, UNIT E/F at least from 6.2' down. Not sure if the sand is UNIT E/F or UNIT D

W-82-63

Bedrock is exposed at the base of this exposure which is oriented 105°, 30° slope
ELEV. 1927' @ 92° @ 61° (1907')

Bedrock is an orange highly oxidized and fractured, igneous rock. It appears to be a quartz diorite and a green tuff(?). Andesite matrix w/ coarse grained to gravel rock fragments(?). Possible debris associated w/ the shearing. Sampled.

It appears to be a diorite breccia. Andesite matrix with gravel to cobble size fragments of the quartz (?) diorite.

Appears to be a thin layer of gravelly sandy clay with may contain gravel & cobbles. This material is flowing

ELEV. TOP OF UNCONSOLIDATED MATERIAL
(1979') 2002' @ 9³¹' @ 61°

beneath the vegetation mat out over the sandy gravel material which is beneath it. The clayey material resembles the till in UNIT G, it is moist, soft, highly plastic, and cohesive. Almost within, probably a foot or two beneath the altimeter reading is the sandy gravel. The gravel is generally subrounded with some rounded. It ranges from gravel to boulders, one being 6' across, several 3', but most are less than 12". Many are in the 3" and 6" range. Therefore this gravelly sand is roughly 10' thick. The matrix

15
oxidized

is a medium to coarse grained sand. It appears there is a talus in 30' above the bedrock elevation.

2° 25° W

It appears that the top material is a dark yellow brown gravelly, sandy-clay. Approx. 30% gravel to cobbles. Has a thickness (approx.) of 2' to 5'.

- UNIT G - Till

W-82-64

Small exposure on side of ridge, a slump oriented 140°. Material is a dark yellow brown gravelly, silty-clay. ELEV. approx. 5111' local

2041' @ 10¹²' @ 61° (2012')

Gravel comprises roughly 30%, most are subrounded. Material is poorly graded damp to dry, nonplastic, dense, compact. This is a till, probably UNIT G.

11-82-67

... silty, gravelly
... gravel to cobbles ... 35%,
generally subrounded. Silt ...
... Sand is fine to medium
grained, primarily fine grained. Moist
moderate dense, poorly graded, non
plastic.

Material could be a sandy till (in
Unit G) but it's difficult to say. ...
to help determine if part of

(2210') ELEV. 2246' @ 11° @ 65°

UNIT E/F or indeed it is unit G

Sandy silt CL-ML

Exposed again farther down slope

~ 60' (?) resembles the till

11-82-66

Alluvial terrace. Sandy gravel.
Gravel ranges up to boulders, comprises
50-60%, subangular to rounded,
primarily subrounded. Matrix is
medium to coarse grained, primarily
medium. Moist, loose, poorly
graded. Less than 5% fines.

Terrace does not appear to have ...
down (Gravel ... 3' - 5', up to 3' ...

ELEV. above exposed bottom terrace

2016 @ 11° @ 65°

(1975')

ELEV. ...

2052' @ 11° @ 65°

RIVER ALLUVIUM (2011')

11-82-67

Matrix, exposure oriented ...

80. Material is ... dark yellowish brown
gravelly - clay with some sand. Coarse
material ranges from gravel to boulders,
subangular and subrounded, comprises
... 20-25%. Matrix is
clay with approx 15% to 20% fine to coarse
grained sand. Wet to very wet,
soft, cohesive, highly plastic, poorly
graded.

ELEV. AT TOP

2214' @ 11° @ 71°

(2161')

TILL, UNIT G

W-82-68

Part of the same massive volume as the previous exposure. Oriented 60° on the side of a ridge, 15' vertical exposure. Material is a gravelly, sandy silt; dark yellow brown. Gravel to cobbles comprise 20%, most are subrounded, some are striated. Sand is primarily fine grained with some medium grained; comprises ~30% (?). Damp, firm, non-plastic, poorly graded, compact.

ELEV. AT TOP (2221')

2277' @ 13° @ 71°

TILL, UNIT G

Across the river the hummocky terrain, ice disintegration features are visible. Bedrock & talus are exposed on the d/s end of the alluvial terrace across the creek.

W-82-69

Dark yellow brown: sandy, gravelly clay. Gravel to boulder size, subrounded.

ELEV. TOP (2136')

2196' @ 22° @

and subangular, comprise ~25%. Generally are less than 6" in diam. Sand ranges from fine to coarse grained, only a small amount of medium grained. Moist firm, moderate plasticity, poorly graded. Some clasts are striated, a large number are elongated.

Approx. 50' higher in a small exposure the same material as 82-68 was visible. This unit is probably just sandier towards the top. Orientation of mudflow 140° on a 25°-35° slope.

TILL, UNIT G

W-82-70

On a small ridge near 82-67, the same ridge I walked down to get 82-67, 68. Exposure as a result of a fallen tree.

0.0 - 0.3' ORGANICS, VEGETATION MAT

0.3' - 1.0' ORANGE - BROWN Sand with some cobbles & boulders. Oxidized soil. Sand is fine to medium grained. Some silt. Moist, loose, well sorted.

1.0' - > 3.0' Light olive gray gravelly sand. Gravel and cobbles comprise 25-30%, subangular and subround. Fine to coarse grained sand, primarily fine to medium. Moist, loose, poorly sorted.

OUTWASH OR ALLUVIUM

ELEV. TOP

2338' @ 3⁰⁵ @ 66°
(2270')

Will survey opposite side of Tawana
(wells for tomorrow).

Watawa 2346' @ 5²² @ 58°

Samples:

W-82-1A	SM	Silty sand
W-82-1B	SM	Silty sand
W-82-2(4)	CH	Clay (?)
W-82-2(5)	ML	Sandy silt
W-82-2(1)	GW	Sandy gravel
W-82-6	MH	Sandy silt (?)
W-82-13	GW-SW	Gravelly-sand
W-82-22	CL	Silty clay (?)
W-82-35	SM	Gravelly-sand
W-82-37(2)	ML	Sandy-silt (?)
W-82-37(3)	SM	Gravelly, silty-sand
W-82-41(2)	CL-CH	Sandy-clay or Silty-clay
W-82-65	CL-ML	Sandy-silt

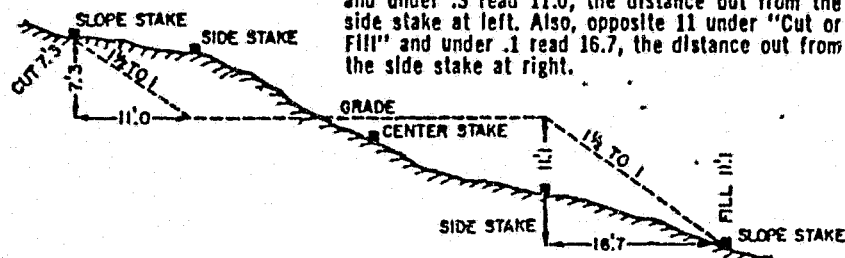
Sheet

AAI BOOK 19

DISTANCES FROM SIDE STAKES FOR CROSS-SECTIONING

Roadway of any Width. Side Slopes 1½ to 1.

In the figure below: opposite 7 under "Cut or Fill" and under .3 read 11.0, the distance out from the side stake at left. Also, opposite 11 under "Cut or Fill" and under .1 read 16.7, the distance out from the side stake at right.



Cut or Fill	0	.1	.2	.3	.4	.5	.6	.7	.8	.9	Cut or Fill
	Distance out from Side or Shoulder Stake										
0	0.0	0.2	0.3	0.5	0.6	0.8	0.9	1.1	1.2	1.4	0
1	1.5	1.7	1.8	2.0	2.1	2.3	2.4	2.6	2.7	2.9	1
2	3.0	3.2	3.3	3.5	3.6	3.8	3.9	4.1	4.2	4.4	2
3	4.5	4.7	4.8	5.0	5.1	5.3	5.4	5.6	5.7	5.9	3
4	6.0	6.2	6.3	6.5	6.6	6.8	6.9	7.1	7.2	7.4	4
5	7.5	7.7	7.8	8.0	8.1	8.3	8.4	8.6	8.7	8.9	5
6	9.0	9.2	9.3	9.5	9.6	9.8	9.9	10.1	10.2	10.4	6
7	10.5	10.7	10.8	11.0	11.1	11.3	11.4	11.6	11.7	11.9	7
8	12.0	12.2	12.3	12.5	12.6	12.8	12.9	13.1	13.2	13.4	8
9	13.5	13.7	13.8	14.0	14.1	14.3	14.4	14.6	14.7	14.9	9
10	15.0	15.2	15.3	15.5	15.6	15.8	15.9	16.1	16.2	16.4	10
11	16.5	16.7	16.8	17.0	17.1	17.3	17.4	17.6	17.7	17.9	11
12	18.0	18.2	18.3	18.5	18.6	18.8	18.9	19.1	19.2	19.4	12
13	19.5	19.7	19.8	20.0	20.1	20.3	20.4	20.6	20.7	20.9	13
14	21.0	21.2	21.3	21.5	21.6	21.8	21.9	22.1	22.2	22.4	14
15	22.5	22.7	22.8	23.0	23.1	23.3	23.4	23.6	23.7	23.9	15
16	24.0	24.2	24.3	24.5	24.6	24.8	24.9	25.1	25.2	25.4	16
17	25.5	25.7	25.8	26.0	26.1	26.3	26.4	26.6	26.7	26.9	17
18	27.0	27.2	27.3	27.5	27.6	27.8	27.9	28.1	28.2	28.4	18
19	28.5	28.7	28.8	29.0	29.1	29.3	29.4	29.6	29.7	29.9	19
20	30.0	30.2	30.3	30.5	30.6	30.8	30.9	31.1	31.2	31.4	20
21	31.5	31.7	31.8	32.0	32.1	32.3	32.4	32.6	32.7	32.9	21
22	33.0	33.2	33.3	33.5	33.6	33.8	33.9	34.1	34.2	34.4	22
23	34.5	34.7	34.8	35.0	35.1	35.3	35.4	35.6	35.7	35.9	23
24	36.0	36.2	36.3	36.5	36.6	36.8	36.9	37.1	37.2	37.4	24
25	37.5	37.7	37.8	38.0	38.1	38.3	38.4	38.6	38.7	38.9	25
26	39.0	39.2	39.3	39.5	39.6	39.8	39.9	40.1	40.2	40.4	26
27	40.5	40.7	40.8	41.0	41.1	41.3	41.4	41.6	41.7	41.9	27
28	42.0	42.2	42.3	42.5	42.6	42.8	42.9	43.1	43.2	43.4	28
29	43.5	43.7	43.8	44.0	44.1	44.3	44.4	44.6	44.7	44.9	29
30	45.0	45.2	45.3	45.5	45.6	45.8	45.9	46.1	46.2	46.4	30
31	46.5	46.7	46.8	47.0	47.1	47.3	47.4	47.6	47.7	47.9	31
32	48.0	48.2	48.3	48.5	48.6	48.8	48.9	49.1	49.2	49.4	32
33	49.5	49.7	49.8	50.0	50.1	50.3	50.4	50.6	50.7	50.9	33
34	51.0	51.2	51.3	51.5	51.6	51.8	51.9	52.1	52.2	52.4	34
35	52.5	52.7	52.8	53.0	53.1	53.3	53.4	53.6	53.7	53.9	35
36	54.0	54.2	54.3	54.5	54.6	54.8	54.9	55.1	55.2	55.4	36
37	55.5	55.7	55.8	56.0	56.1	56.3	56.4	56.6	56.7	56.9	37
38	57.0	57.2	57.3	57.5	57.6	57.8	57.9	58.1	58.2	58.4	38
39	58.5	58.7	58.8	59.0	59.1	59.3	59.4	59.6	59.7	59.9	39
40	60.0	60.2	60.3	60.5	60.6	60.8	60.9	61.1	61.2	61.4	40

Field Book 19

CONTENTS

LAYOUT:

Control Points

1-3, 21

GEOLOGIC MAPPING:

Upstream Portal

Downstream Portal

58-89, 105-11

Right abutment c/c

7-19

Left abutment c/c

22-27

SURFICIAL MAPPING:

Tsusea Creek

28-54

Deadman Creek

90-102

STA NUMBERS:

W82-71 through 94B

101 " 136

201 " 207



The paper in this book is made of 50% high grade rag stock with a WATER RESISTING surface sizing.

KEUFFEL & ESSER CO.

7/28/82 Wednesday
Partly sunny 60°

KJW - Dome

MPB - Towera Creek

Book 18

South bank of Dome
north of DH-250, set out
left abutment survey
control LASC-1 at
top of cliff see topo and
aerial photo checked

Superficial geology map for
outcrop on north bank
between road & ups toe of
Dome ~~concordance~~ to map
Too much vegetation to
check properly

Also checked for zone GF5 and
GF4A+4B for topo
alignment. Possible frag-
ment trending 295° in
44A gully aligning with GF5

Will have to check further
downslope and at GFS on
north bank

Took polaroid shots of
north bank

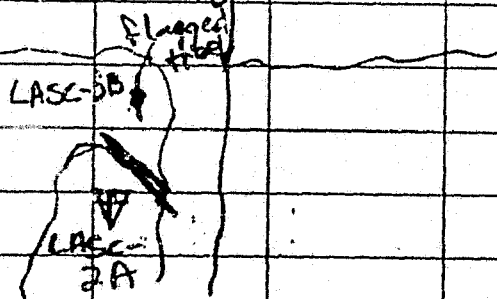
PM. Moved downstream to
DH-2B to set up next
survey control points

Set out two possible
locations for LASC-2
Which site chosen will depend
on surveyors

LASC-2A is lower on slope
but difficult access

LASC-2B is above crossing
gully

both sites require heavy
brushing



Set up LASC-3 on south
bank overlooking
D/S portal area - light
brushing

Tried to visually line
up several of the known
shears on either side
of the river. Still
pretty much guess work
deciding what correlates.

7/29 Rain. Office Day.

7/30 Rain

KJW Instrumentation on AH-11
MPB Leave

7/31 Partly Sunny 7:30 AM

KJW Watered south bank

Checking outcrop map at
BH-6 Helipad - see note on
map

Also checked geol map for
Shears. Two zones on south
bank, orange yellow staining
and more fractured than rock
above, no exposure below; prob
related to F3, shear zones
mapped here previously, but
not correlated, both areas
trend into thick talus slopes
Note on map and photo Q-4

Polaroid photos of south bank

Photo K82-34 of dump

Below BH-8+12

Features to Photograph

North bank

South bank

upward incl. of dm

1/5 point incl. of dm

W 82 101

A Outcrop beneath 20 vert ft below
 u/sand of SL 82-Ka
 west side of gully GF5
 end of outcrop up slope 2 30 ft

Diorite, fresh to old with
 20' wide FeOx on many of its surfaces
 zone outcrop has fractured appearance
 gravel sp. for some 1/2 mi.
 outcrop may have slumped
 joints

340/80 East

shows one face of scintillated
 pattern to outcrop
 FeOx stain sp ~ 1 ft
 pl, sm

225/70 range ~ 85 N to S
 forms other face in gully
 about parallel to gully
 pl - in and
 strike is approx due to
 irregularity
 Sp 6" - 1 ft

280/45 S

pl. ss

sp. 2"-1ft, gen 6"
dip toward river

W8Z-102

B further down gully
35 vert ft below "A"Diorite, massive
well defined joints080/85° S parallel to gully !!
pl - sl and
sm, cont
sp 1-4", av 2ft005/70° E
pl sm, cont
4-18", av 1ft
cont

trend of gully and it do not align

same EL as "A"

Crossing gully eastward
talus exposed in places consist
of angular blocks of diorite
41° - 1ft, gen 4-6" Fe Oxideno bedrock exposure but
assume fracture zone is axed
on size of talusnoted several cobbles with
evidence of hydrothermal
solutioning - some filled
with quartzdiorite free to mod with
found one cobble that has
a zone that is mod altered by
hydrothermal solutioningnarrow ridge in gully 10-30'
wide + 10ft high trending
downslope, consisting of
sl - mod with all diorite
that is highly fractured
free sl - mod sp. seems to.

but with frac + with alt
you would not expect a
ridge former.
Possible slump block?

WBZ 103

C ridge on east side of gully
see map

Diorite, fine grained, sl-
mod. wt'd. FeOx stain
but no apparent fractures
along numerous poorly
defined fractures, rock is
medium hard.

Joints

A 35°/45° E but range to 20° E
pl. sm, sp 1 in - 2 ft
highly variable, ev 6 in

B D60/65 NW

pl. sm - rgh, gen sm
sp 6 in - 1 ft.

blocks plucked out along these
two sets


gully

Also numerous irregular,
discontinuous fractures

around other side of outcrop
Joint face 300°/65° W
forms cliff face, and east
side of gully

Diorite is fresh - sl. wt'd, hard

ridge between GF 4 + 5

W 82-101

D west side of ridge - GF4
wide gully with thin
rock ribs and narrow
gullies within

- narrow gully on west side
10ft wide, trend 320°
rock on west is somewhat
less fractured than on
east, probably zone in gully

Joints west side of an gully
305/70 face on west side
pl, sm - sl, sp 2' - 6"

030/70° E
pl - sl cnd, sm
sp 2-6 in

325/20 NE
pl, sm
sp 2" - 1 ft, or 6

diorite on east in slotted

Photo K 82-2-1

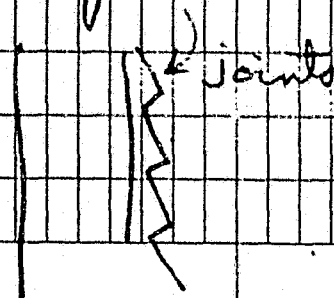
hammer, fractured rock
looking NW

W 82-105

E. East side of GF4 on
east gully wall

Diorite, fine - med grained
fresh - sl with occasional
grayish green, later modded
outcrop varies from
blocky to fractured in appearance
FeOx stain on all surfaces

Joints
305/75 W
pl, sm - sl, sp 1 ft
face of gully, but not
parallel to trend



030/70° 1' wide ~~thin~~ ~~horizontal~~ $\frac{1}{2}$ " sp
pl, sm
sp 2" - 18", av 1 ft
possible ~~shale~~ on one
possible ~~outlet~~

010/70 W

slip ~~nick~~ 260°

320/30° NE

pl, sm, discont
sp 18"

W82-106

F

East side of gully at SL82-Kc

Disint, fresh - slw to

FeOx ~~str~~

possible slumping of blocks along
N.W. ft. sat

Joints

305/85 N to 85 S facemaker

pl, ol rgt to sm

sp 6 in - 2 ft av 1 ft

strongly continuous

035/80 SE

pl - sl and, sm

sp 2 in to 3 ft av varies

3 ft of a fine zone

exposed, possibly wider

Following SL82-Kc

talus partially exposed

boulders 2-3 ft up to 4'

ends in gully at about

3+50

W82-107

G

SL82-Kc at 4+10 to ~500

Disint, fresh, hard

Outcrop is fractured along
several joint planes many

are open - outcrop may

have slumped in parts

Joints

305/45 NE

pl - sl and sm

sp 1/2" to 18", av 1 ft

035/90

pl - sl and sl rgh

sp 6" - 12"

300/55° N

pl, rgh

sp 1" - 5 ft, variable and
discontinuous, although
occ well developed

W 108

G

See map

Base of outcrop, above
talus slope, angular blocks
spilling off cliff face, from
1 inch to 3 ft, even 1-2 ft
outcrop ~ 100 ft x 30' highDiorite, fresh, hard, lt gray
several well defined joints
and irregular fractures,
many open and slumpedZones of diorite breccia,
healed, orientationuniform, appear irregular
land, fresh

Hints (all approximate)

030/90

irreg, rgh, some open 6"
sp 1 in - 3 ft, av 6' 1 ft

295/85 W

pl, sm

sp av 6 in

CO₂ veins along fissures,
discontinuous

Subhorizontal, dipping less
than 10° generally east and
south

$\sim 65^\circ/30^\circ$ NW
curved, rgh, sp 1 ft,
seem discontinuous,

Blocks spalling along planes
of primarily the first 3 planes,
and also last plane

all the trace of CO_2

Felsic like (out of reach)
lt yellow-gray, fine grained,
18 in thick tight welded
contacts, slightly more
fractured than diorite
very approx $040/40^\circ$ NW

No FeOx or alteration

Pick up at 5:45 PM

8/1/82 Sunny Sunday

Check

- Outcrop 185 on south bank for clearing
- Flag 5682 - the endpoint for survey control
- downstream volcaniclastics & volcanics
- Fog Creek volcanics
- Backside of Quarry A
- Section to bet. Deadman & Wataona
- Mt Wataona

Set out survey control

RASC - 1 on north bank

75' down slope from 5682 - the E endpoint

Only brush clump of bracken on u/s side, no d/s brushing.

W8Z-109

A outcrop 50' SW of 81-135

Discrete or possible
 granodiorite, light grayish-
 pink green, fine grained with
 some med grained feldspar,
 ~ 20% quartz and
 possible potash feldspar.
 10-20% mafics, fresh, hard,
 v. thin with red.

Outcrop is broken along
 several joint planes

Joints

350/75°W

pl, sm

sp 6"-1 ft

300/45°S

pl, sm - along, sp 6"-2 ft

005/70°E

pl, sm, sp 6"-1 ft

Return to 81-135

Surface of outcrop is pl -
 mod with with FeO stain
 (see notes from 1981)

Most joints are closely
 spaced with zones of
 v. cl. spacing on NE-NW sets.
 most joints are open and
 talus forming at base of
 outcrop
 weathering and appearance
 is similar to the shear
 area in F8, no shear
 found here, of course
 305° joint trend
 possibly no shearing but
 open jts to depth

Photo K82-2 27+28
looking S/S from
DH-21 toward
fingertursten

W-2-110

B Outcrop on river (North)
in volcaniclastic
see airphoto/topo map

Andesite (?) overlying
siltstone (volcaniclastic?)
siltstone baked, hard
and very brittle,
v. cl. fr. abn. v. cl.
it planes, fresh, with

scinty

060/25° S

pl, sm, very cont
sp 1"-2", orb in
FeOx str

345/70° E

pl, sm, FeOx str
sp 1"-8"

000/20° W prob bedding
irregular
sp 1/2"-1 cm

Andesite overlying
siltstone and has baked
it.

Samples of both types

- Andesitic flows also within
volcaniclastic
- outcrops on both
sides of river

all cap. by andesite
flows as at quarry A

AND

Volcanic
clastics

And

Dio

WBZ-111

C Fog Creek
Sample of Tertiary
volcanics

Outcrop across from
WBZ-228. ^{Creek}

WBZ-112

D Susitna River - see Topo Map
W/S from domite

Kag / Taged contact
photo

085/75°W contact parallel
to bedding / foliation

thinly foliated argillite

Dark gray, feldspar

foliated, 1/2 in wide intrude
at contact

granodiorite, light gray

fine-med grnd, 25-35%
biotite, no chilled margin

Joints

Granite

290/70°S

pl, sm, up 6"-3'
does not continue through
argillite

Granite + argillite

340/35 E

pl, al, rgh

up highly variable 4 in to
25 ft, or may be 2', not
well developed

055/25°SE

pl, sm, up 1'-2'
well developed

50' downstream block of
argillite end, surrounded
by granodiorite: xenolith
approx dimension 10' thick,
7.5' long

other blocks of various
sizes seen downstream

8-2-82

It's a beautiful sunny day. Bored surveyor's and brushers on survey control points & seismic lines. Will work in Tsusena Creek on the east side.

Watana 2260' @ 11²⁵ @ 67°

W-82-71

Stratified exposure of material on a west facing slope. The strike & dip of the material are:

220° 14° SE

175° 9° E

The range in material has layers of sandy gravel, silty sand, sand, sandy silt;

Units in exposure

3' exposure Sand - poorly graded, fine grained with some medium & coarse grained, uniform sand, < 5% fines. Moist, moderate dense

light brown, moderate yellow brown.

- unit contains light brown silty sand (~~some sandy silt~~) layers.

Wet, moderate dense, non-plastic primarily fine grained sand, ~10% fines. Generally < 1/4". Appears discontinuous

- light brown sandy silt layers.

Wet, non-plastic, moderate dense/firm. Approx. 1/4" thick, continuous

Sand is fine grained, uniform

- light brown sandy, gravel. Moist, loose. Gravel to cobble size (< 6"), comprises 65%; subangular & subrounded, some cobbles are disintegrating. Matrix is fine to coarse grained, primarily medium grained. Some silt 5-10%. Unit is 5" thick. Generally

Sandy-gravel - 3" sandy silt layer overlies this sandy-gravel, grain size increases upward away from this sharp contact.

Gravel to cobble size, subrounded to subangular, fine gravel to 6", aver. 1"-2" comprises 70-80% Fine to coarse grained sand matrix, mostly medium. Poorly graded sand fraction; ~5% fines. High concentration of gravel in the upper 3" to 4".

ELEV. Sand / Sandy Gravel contact -
(1963') 1985' @ 14' @ 67

PHOTOS: K82-2; 4-5

PITS were dug ~3' below sloping surface. Further down in the slope the sandy gravel becomes bouldery with boulders up to 3' across

W-82-72

Exposure on a SW facing slope ~75' from 82-71.

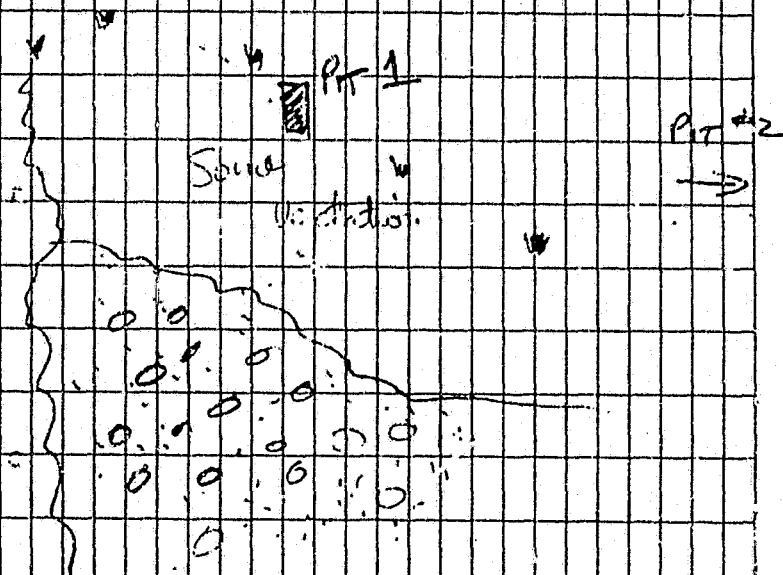
PIT #1

Sandy gravel. Well graded. Fine gravel to cobble size, few boulders to 2'. Aver. 6" to 1', subrounded mostly.

ELEV.

TOP

2025' @ 155 @ 67"
(2001')



estimate 20% sand. Most cobbles have a silt/clay coating. Wet, loose ~5% fines. Matrix is fine to coarse grained, primarily medium grained. Dark yellowish brown.

UNIT E/F?

PIT #2

Approx 100' farther d/s along slope. Bottom of exposure of the same sandy gravel

1965' 222 @ 48°
(1935')

Most cobbles are iron stained. Remain
subrounded gravel & cobbles, some
rounded (more than what has been
observed lately).

Possible?

UNIT Hor I/J ←

Boulders up to 1.5'.

— Photo K82-2;6

U-82-73

Sandy till exposure, gravelly, sandy
silt. Gravel to cobbles, up to 4" generally
but in the exposure there are boulders
to 2', some are striated, subrounded
to subangular. Damp to moist, compact,
dense. Fine to coarse grained sand,
comprises approx 20%. Appears to
be some small pockets or very thin
discontinuous lenses of sand. Material
breaks off in chipped fragments.

ELEV TOP / (2126')

2145' @ 3° @ 47°

Exposure is 10' high, on SW slope

— Photo K82-2;7

UNIT G

Sandy Till is similar to that exposed

at 82-65. Gravel comprises 15-
20% Moderate greenish gray?

Sampled: 4% Gravel
55% Sand
28% Silt
11% Clay

U-82-74

Teasena Creek side of a topographic
high, in knob (id).

Gravelly sand. Gravel comprises
30-40%, subangular & subrounded - coated
with a silt or clay. Gravel & cobbles with
some boulders (2.5'), over 2"-4".
Fine to coarse grained sand, primarily
medium. Poorly graded, < 5% fines,
damp, loose. Moderate yellow brown

ELEV. TOP. (2118')

2164' @ 3° @ 70° 31% Gravel
57% Sand
14% Fines

Sampled.

UNIT C ice disintegration
non-stratified, outwash

U-82-75

Near 82-74, slightly d/s is a
contact between outwash & till

0.0 - 6.0' Gravelly sand same as
 UNIT C STA 82-74 Has disintegrating
 Cobble. Cobble right at
 the contact one inch thick, no
 high concentration of boulder/cobbles
 2.1 - 2.16' Gravelly silty-sand. Gravel
 to cobble size clasts comprise
 UNIT E 20-30%, subangular & sub-
 rounded, generally < 6". Fine
 to coarse grained sand within
 the silt. Damp, hard, dense
 compact, non-plastic.

ELEV OF CONTACT

2126' @ 4³² @ 68°
 (2074')

Small pockets & lenses of fine
 grained sand some medium
 Sandy Till similar to 82-73
 - ?

UNIT E/F & G contact!

K82-2; 8

* Going downslope from here towards
 the river.

W-82-74

ELEV. TOP (1971')

2046' @ 4⁴⁵ @ 67°

New material estimate thickness of till,
 unit G is $\leq 40'$ not the 80' change
 in elevation.

Exposure is on W-NW facing slope
 & is approx 30' high.

Sandy gravel Gravel to boulder
 size in the exposure, comprise 80-90%
 subangular & subrounded, most are
 elongate, over 2" to 4" at top, 8" to 1"
 further down in the exposure. Fine to
 coarse grained sand, < 5% fines.
 Wet loose, slightly compact, poorly
 graded. Dark moderate brown

OUTWASH UNIT H

(1117')

ELEV. 1976' @ 5¹¹ @ 67°

base of exposure a continuation of above
 estimate thickness is now a minimum
 of 100'

Still a sandy gravel, moderate yellow brown - Here the material is oxidized unlike that higher up in the unit. Gravel is mostly subrounded, gravel to boulders up to 18", comprise 80%, over 6" to 1'. Fine to coarse grained sand, primarily medium, < 5% fines. Moist, loose, well-graded.

OUTWASH

W-82-77

Moderate yellow brown sand. Primarily fine grained sand with ~10% medium & coarse grained. Moist, dense, compact (1870') ELEV 1932' @ 52° @ 66°

stratified 290° 9° S ?

Some thin sandy silt layers/lenses 30-40% fine grained sand. Poorly graded, uniform sand; 2-5% fines

Could be a lens or layer within the outwash or another unit.

Grades finer upslope

Pit on the side of a ridge going downslope

Further down slope on ridge

ELEV 1886' @ 54° (1820')

Uniform fine grained sand. Moist, dense to very dense, poorly graded. Light olive gray or moderate olive brown (?).

In gully adjacent to ridge we descended downslope. Water is coming out of the slope at ~4-5 gals/min.

ELEV.

1868' @ 60° @ 65° (1800')

W-82-78

Material is suspect due to its nearness to the slope drainage. Sandy silt, gravel. Gravel comprises 70%, subangular to subrounded, up to 8" generally < 3". Sand is fine to coarse grained. Wet, loose, non-plastic, soft.

ELEV.

1860' @ 61° @ 64° (1791')

W-82-79

Bedrock - just above creek

Elev. Top of (1770')

1840' @ 6" @ 5°

Lt gray to whitish gray, medium grained
granitic rock, some coarse grained
pieces eyes. Quartz = 20-25%

Mafics ~ 20%, probably 14% mafics

Hard to moderate hard, slight to irregularly
weathered. Carbonate stainingQuartz diorite or granodiorite
some hbl.

Photo K82-2, 9

Bedrock at creek level

Granodiorite, white gray; medium &
coarse grained. Mafics comprise 2% in
biotite, lots of quartz. Many
small dikes & veins - fine grained
felsic.

JOINTS:

* 280° 80° N 1'-2'
shear zone* 310° 85° S plane - slightly
curved, smooth to rough
1" to 3' over 2'

355°

85° W plane, smooth
10"

Watana

2345' @ 7" @ 5°

8-3-82

It's a mostly sunny day with
high thin clouds. Will continue
driving in Tussera Creek along
the east side

Waters

2260' @ 6⁵⁵ @ 48°

Above Tussera Creek, east
bank on north side of
major drainage

W 82-80

EL. 1967' 7:35 AM.

(1963')

Sandy gravel, 60-70% fine
grained to cobbles (8 in) most
coated with silt/clay,
rounded to subrounded,
some subangular, poorly
graded, fine to coarse sand

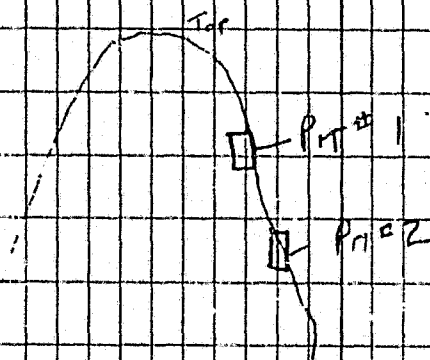
mostly medium, about 5%
fines, moist, loose
moderate yellow brown to
dark yellow brown

Outcrop 15' high (vert)
elevation at top
SW facing slope

Unit E & F (?) Artwash

W-82-81

Old exposure on a N-NE facing
slope, 35° slope. Undercutting of
slope probably caused this failure.



PIT #1

Gravelly sand, well graded. Gravel comprise 25-30%, gravel and cobbles up to 8", aver. 1"-2", generally subrounded to rounded. Fine to coarse grained sand, ~5% fines. Some gravel & cobbles have silt/clay coating, ~10%. Moist, moderately dense. Moderate yellowish brown.

ELEV.

1858' @ 8° @ 52°
(1851')

PIT #2 (approx 6-7' below PIT #1)

Stratified deposit. Gravelly sand interlayered with sand & sandy silt layers.

PIT

Gravelly sand, poorly graded. Mostly medium grained, some fine grained, trace coarse grained. Moist moderate dense. Gravel to cobbles sizes up to 4", subrounded 15-20%. Moderate yellowish brown.

TOP

Sandy silt. Moist, firm non-plastic. Sand is fine grained, 25-35%. Moderate olive brown. Up to 2" thick.

TOP Sand - Poorly graded. Fine and medium grained, mostly medium. Uniform sand. Moist, moderate dense, moderate yellowish brown.

Irregular zones of oxidation in the gravelly sand layer.

Exposure: 120' section

Photo K82-2; 10

The thicker coarse silt is 10' above the gully drainage.

W-82-E-2

Sandy gravel. Well graded. Moist, compact, dense. Gravel to boulders up to 2', aver. 2", subrounded and subangular. Sand comprises 25-35%, fine to coarse grained, 1-2% fines.

ELEV.

1802' @ 8° @ 55°
(1772')

W 82-83

At creek level adjacent to 4/5
extent of bedrock (1193')

Bot 1704' @ 9° @ 55° creek level

Top 1752' @ 9° @ 55° (1740')

- bedrock is a minimum 10' thick
across the drainage - 50' from
here. See 82-79

Believe we came downslope through
J' and K on our traverse down
to Tsucena Creek

Same bedrock as at 82-79

Granodiorite or quartz diorite. Containing
large rocks of white plagioclase

JOINTS: in addition to 82-79

* 350° 45° E plane slightly
curved 2"-6'
over 2'-3'

* 90° vert - 85° N plane to sl. curved,
slightly rough; 8" to 4"
over 2'

W 82-84

Well concealed (vegetation) bedrock
outcrop which continues d/s of this point
@ ELEV. 1761' @ 9° @ 58° (1746')
Bedrock forms a small bench before
dropping off.

Bedrock is a granodiorite, medium
grained. Quartz rich. Biotite are
biotite, may be some hornblende.
Ct = 5-20%, some chloritization.
Massive, hard, competent.

Further downstream approx the same
elevation, on bench above bedrock
outcrop. (1739')

(b) ELEV. 1758' @ 10° @ 64°

W 82-85

Bedrock elevation descends & ends, have
a small bedrock cliff

(c) ELEV. 1717' @ 10° @ 64°

Top of Rock

(1697')

cont next page

W82-85

Bedrock, granodiorite. Medium grained, 20% quartz, 20% mafic — biotite. Mafics are partially chloritized. Alteration zone which is cross cut by a dike. Could have possibly been some early shearing but nothing since the emplacement of the dike — felsic — aphanitic, almost glassy, greenish-gray.

Dike 295° 65° N 4"-6" wide pinches out. Highly fractured, closely jointed.

Alteration zone 310° vert. to 80° NE aver. 4' wide. Some feldspars have broken down to clay minerals but not the large phenocrysts.

Photo K82-2; 12, 13

JOINTS:

350° 60° W plane, smooth. spacing of 1'-2'

310° 75° SW goes through dike curved, smooth; 1" in alteration zone, to 8" — or truncated by;

320° 45° NE plane, smooth 1' to 2'

In walking up the ridge, have the feeling that the top of rock is higher. Ridge lines up w/ → W82-86 ^{oxidized zone on west side of creek}

Mudflow slump exposure on a N facing slope, sloping at 12°. (1899')

ELEV 1924' @ 11³² @ 67'

This mudflow occurs in a topographic bowl shape depression, at the edge before it drops off & down to the coast.

Sandy clay with trace gravel to cobbles. Moderately to highly plastic. Gravel & cobbles up to 6", aver. 2", subrounded, ~10-15%. Sand comprise 15-25%, fine to medium grained mostly medium. Wet to very wet, very soft (at surface), cohesive. Medium gray (dark moderate brown?).

Because of the morphometry, may be related to the bottom of this material. The unit G

W82-87

Small pit on the ^{west} side of the ridge. Sandy gravel. Gravel to boulders, comprise 10%, subrounded, some subangular & rounded, up to 1.5' and 1"-3".

Well graded fine to coarse grained sand. Wet, loose; ~5% fines

(1963')

ELEV. 1991' @ 12.5° @ 67°

✓ UNIT E/F(?) gravel concentration is indicative of, but usually don't have a great deal of fines.

W82-88

Skin flow, scar on a NW facing slope, sloping 30°

(1934')

ELEV. 1964' @ 12.9° @ 69°

0.0-1.5' Sandy clay. Fine grained sand. Moderately plastic. Sand comprises 10-20%. Gravel comprises ~10%, generally 1/2"-1", subangular & subrounded, some are polished

Moist, firm, cohesive. Medium gray - material appears to be flowing beneath the vegetation mat

- material from Unit G

1.5' → Sandy gravel. Gravel and cobbles comprises 70-80%, subrounded & subangular, up to 10", and 1"-2".

Well graded, fine to coarse grained sand. Moist, moderate dense. places it is compact, ~5% fines. Medium gray. Similar to material at 82-87.

No ⇒ ~~unit below G, could it be~~
UNIT I - sandy silt

W82-89

Sandy gravel exposed on a N-NE facing slope. Gravel to boulder size, up to 6', many 3"; primarily subrounded, comprise 80-90%. Many cobbles/boulders have broken down to sand. Fine to coarse
↑ deeply weathered

ELEV. 1929' @ 2.8° @ 68°
(1891')

grained sand matrix with mostly medium & coarse grained. Poorly graded (?), moist, compact, dense < 1% fines

High concentration of large boulders at the top of the exposure - layer? ~15' high. Lots of phlogopite sp.

Flagged, exposure is 15' high - the degree of weathering of the boulders suggests that the material may be relatively old.
- some shale fragments.

W82-90

Similar to 82-88, the bottom mat. l. Sandy gravel, ~ 10% silt, 60% gravel 30% sand. Well graded, moist, moderate dense. Mostly medium & coarse grained sand. The large boulder layer of 82-88 is approx 10' lower than elevation pt.

ELEV. 2001' @ 25° @ 67°
(1959')

Unit E/F ??

W82-91

Exposure on a N facing slope over the edge. Flat upland surface.

0.0 - 1.0 Sand uniform, poorly graded. Fine to medium grained.

UNIT A/C 5-10% silt. Contains sandy-silt layers. Moist, moderate dense. Silt layers up to 2". Moderate yellow brown

1.0 - > 10' Sandy gravel. Gravel to cobbles, occasional boulder, 1'-2' subrounded & subangular, ~ 80% gravel. Matrix is fine to coarse grained sand mainly coarse. Poorly graded, moist, moderate dense ~ 5% fines. Moderate yellow brown

OUTWASH UNIT E/F 14% Gravel 57% sand 30% Fines SM

ELEV. 2009' @ 34° @ 70°
(1963')

W82-92

Very dense, compact sandy gravel. Oxidized. Some dioritic boulders have disintegrated to allow a very dense compact sand. Gravel comprises 80-90%, mostly subrounded, aver. 1/2" to 1", but up to 2". Yellow brown

UNIT

ELEV. TOP OF EXPOSURE

I

1932' @ 3⁴⁵ @ 10' (1885')

Sand is medium to coarse grained < 2% fines. Damp to moist, very dense may be overconsolidated, compact. Imbrication of elongated cobbles (6"-10" in length)

350° 45° E

Exposure is 20' high

- could it be overconsolidated alluvium(?) does have a good fabric. Pretty good rounding of cobble edges

Suspect but note:

- uniform sand & boulders exposed beneath a tree 15' above.

Uniform fine gr. sand

W82-93

Exposure along small drainage approx half way down the slope

Sandy gravel, oxidized, well graded. Gravel to boulders, up to 2', aver 2"-4", subrounded with a high degree of rounding. Gravel comprises 80-90%. Sand is fine to coarse grained, mostly coarse. Fines comprise 2-5%, moist, moderate dense to dense. Cobbles are iron oxide coated, some are moderately to severely weathered. Possible imbrication

10° 60° E

Alluvium(?) Some shale fragments

ELEV. 1772' @ 4⁴⁰ @ 68° (1720')

Photo K82-2, 14

W82-94

Sandy gravel exposure, very dense, compact, maybe overconsolidated, oxidized. Gravel to boulders, gravel comprises 80-90% up to 4', aver 2"-4', subrounded & some subangular. Damp, well graded, primarily

ELEV. 1720' @ 4⁵⁰ @

(1667')

coarse grained. Highly oxidized & weathered
 Some shale fragments. Similar to 82-93
 Exposure is 7' high on a NW slope

— Photo K82-2; 15

Watana

2320' @ 6'5" @ 64°

Found more bedrock exposed along
 Tsusera Creek than was anticipated. It
 reaches an elevation 1740' max. Found
 some alluvium or outwash today
 which appears to be overconsolidated.
 It is beneath unit G, the till,
 but am not sure what unit it
 belongs to. It may belong to units
 J' or K but the lack of information
 on the materials of these units prevents
 any correlation with a high confidence
 level.

8-4-82

It's another beautiful sunny day.
 Will start mapping in the downstream
 portal area.

Watana 2260' @ 6'45" @ 50°

Will start a traverse from DP-6

ELEV. 1653
 1648' @ 74' @ 51°

DP-6 = A

W82-113 (DP-6; A)

DP-6 is situated on an inactive
 talus slope. The boulders are generally
 in the 2'-3' size range with an
 occasional 4' diam. Slope faces
 south-southwest, sloping ~ 27°. Boulders are generally lichen & moss
 covered. Rock is the greenish gray

diorite. As usual on talus slopes
some of the boulders are loose.

Boulders are primarily angular, hard,
competent - Main chute?

~ 70% of slope - boulders 43

A (82-113) - B 48' 254° 43
- end of talus slope in d/s direction

B - C 100' 288° 44
3° down

- over this stretch still find
some boulders exposed at the
surface but many are completely
covered by vegetation, < 10%
of slope is composed of boulders

- inactive, even older talus
slope (than @ A-B)

- bedrock is roughly 80' upslope 39

C - D 39' 278° 39
2° down

- end of scattered zone of boulders
- start of heavy concentration of
boulders comprising this talus

slope, A few boulders are not
vegetated. Generally loose and
2-3' out up to 5'. ~ 65-75%
boulders covered. Approx. 35° slope
- approx 100' below rock outcrop

D - E 53' 283° 6° down 53

- main chute of talus slope ends
- start vegetated slope 49

E - F 100' 282° 3° up

0-82' only an occasional boulder
82'-100' small area of boulders
not continuous up or down slope
Generally 2-3' size, many
covered

- zone is edge of talus slope

- light gray diorite - can't
see bedrock cliff above 100

F - G 100' 282° 3° up

- still in the talus slope material
Much of the boulders are moss
covered ~ 75% of slope is

boulders

G-H (DP-7) 1699 91' 323° 22° up
 - Elev. 1712' @ 94° @ 59° - DP-7
 - at 28' to 54' is a bedrock outcrop.

W82-114 (at 28' - 54' from G)

Small outcrop in an east-west direction 8' long, 5' high. Most is moss covered. Highly fractured & oxidized appears to be the fine to medium grained gray diorite. Slight to moderately weathered, moderately hard, incompetent

Elev. 1677' @ 90° @ 57°

Fracturing is very irregular & very closely spaced

JOINTS:

I 330° 75° E to 85° W plane, smooth; 1/2" to 8", aver. 2"

II 50° 65° NW; 1/2" to 6", aver. 2" slightly curved, smooth

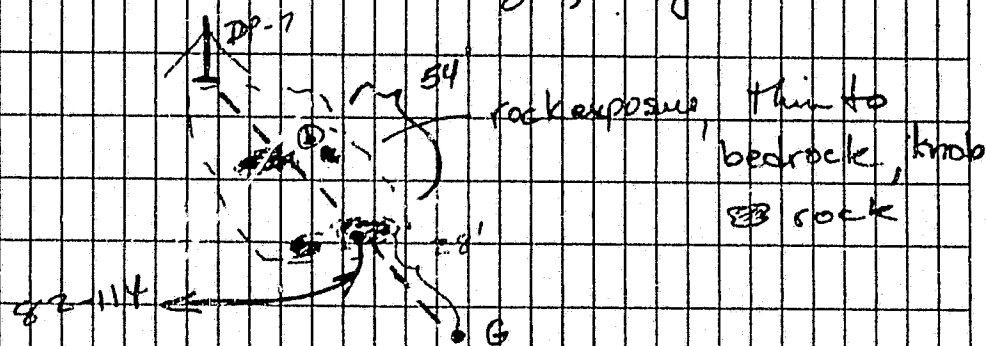
III 35° 55° SE plane, smooth discontinuous(?); 2" to 6"

IV 10° vert. plane, smooth slickensides, vertical spacing 6" to 1'

west side of outcrop possible gouge/breccia
 No evidence of shearing but there are possibilities

Possible shear (?)

10° 85° W 2" wide
 orange, silty sand



- lots of talus just downslope of DP-7

- ~ 110' above is bedrock

(6) Joint

290° vert.

Photo: K82-2, 20

DP-7

Talus slope, generally 1'-3' over 1'-1.5', covers 80% of area w/ 20'. Gray diorite boulders - bedrock is 70' up slope

G to I

100'

280° horiz

100

- still crossing a talus slope
- fallen tree from DP-1 needs to be cut up for seismic line.

I to J

100'

283° horiz.

100

- for the first ~75' talus slope is covered fairly well by the vegetation
- for the last 25' & continuing in the d/s direction the talus slope is better exposed.
- gray diorite boulders 1' to 3'
- bedrock is 100' above, ~40' higher in elevation

J-K

100'

279°

7° up

99

- scattered boulders, still a talus slope

K-L

100'

286°

7° up

99

- boulders, active talus slope which continues all the way

down slope from here

- starts @ 15' from K and continues for 34' d/s of L, 119' mainly active.
- 100% of area is boulder covered up to 6' area, 2'-3' Only some boulders are moss covered, others are completely free of vegetation
- talus slope appears to be quite thick in the 15' to ~70' distance along this segment of the traverse.
- bedrock is approx 100' distance upslope. Gray diorite
- slope of active talus, 40'

L-M

100'

278°

11° up

98

- 0'-34' continued heavy talus w/ some being recently fallen material

- 34'-100' continued talus slope, almost completely covered by vegetation, ~5% exposed

M-N

64.5'

70°

11° up

7

(DP-8)

ELEV. 1734' @ 11° @ 72°

1720

DP-8 is 7' higher than M. *
 - is 10' lower in elevation than
 bedrock cliff; 40'-50' away.
 - talus surrounds this point,
 75% exposed.

M-O 87' 280° 3° UP ⁸⁷
 - for the first ~30' still have
 talus, after that it is primarily
 a vegetated slope.
 - End ~10' downstream; d/slope
 of bedrock outcrop.

Set up a base line at the base of
 this bedrock exposure

O-P O'-41' 87° horiz. ⁰⁻⁴¹
 length of outcrop to the east
 O ELEV. ~~1726'~~ @ 11⁵⁰
 1710
 outcrop aver. 20' high

WEZ-115 (O-P;)

- set up a base line
 - 5.01-0.0 small gully above which the rock is
 exposed, continuous. Greenish gray
 fine and medium grained diorite. Biotite
 is fine grained, C.I. Lath
 shaped x'tals highly oxidized.
 Massive, very hard competent
 - intruded by a felsic dike - fine
 grained to aphanitic, 20-25%
 quartz phenocrysts. Unfractured
 contact w/ diorite, light yellow
 300° 45° NE $\leq 1'$ wide
 - outcrop is slightly oxidized

JOINTS:

I * 295° 70° N - forms face at
 top of gully, plane is curved
 slightly rough, even 2'-3'
 II * 35° 75° W, plane, smooth;
 2' to 3'
 III 0° 75° E discontinuous, plane
 smooth, 6'-1'
 it is 15' above the base line

6.0' - 12.0' Highly fractured portion of the bedrock, thin vegetation cover veneers much of outcrop here. Slightly to moderately weathered.

- rock has few to no mafics, approx 10% quartz, white-gray,
- moderately hard, heavy iron staining

Jointing

11.0' ~~III~~ * 5° 80° E 1" to 1' plane, smooth

I 300° 75° S face of outcrop plane, smooth, aver. 6"

12.0' - 31.0' Rock with <5% mafics, greenish gray, ~10% fine grained quartz. Fine to medium grained. Iron staining, slightly to moderately weathered. Rock is hard, massive competent. Granitic rock.

- small highly fractured zones up to 1' wide along the N/S set are found in the 12'-18' zone.

- at 25' rock is very blocky

JOINTS

32-11.5' I 295° 80° N-85° S; face of outcrop plane, smooth

II 280° 40° S plane, smooth; 2"-3" locally aver 3' to 4'; some continuous 20"

III 0° west-85° W plane, smooth 1' to 3' aver. 18"

31.0'-41.0' Greenish-gray quartz diorite, fine to medium grained, fresh to slightly weathered, very hard, massive, blocky, competent. Same jointing as above.

The 280° 40° S set could pose problems in slope stabilization especially in the portal areas.

D-Q 33' 265° horiz 33'

- at 25' small outcrop 4' high approx. 8' long.

- greenish gray fine and medium grained quartz diorite. Fresh to slightly weathered. Hard, competent

§2-115C JOINTS:

I 335°-355° 80° E plane to curved smooth, 4" to 15" aver. 10"

II 55° 80° SE plane, smooth Fe stained, face of outcrop 18" aver.

IV 250° 25° S plane to slightly irregular, smooth. 6"-3'; ~12'

35

Q-R 41' 338° 31° UP
EL 1771' 2¹⁰ PM @ 74°
11:11

W82-116 (R)

Set up baseline

R=44', O' is to the east @ 95°
95' is to the west

O.O' = S, directly above O.

O.O' = 34.0'
95' = T

at 10' Massive rock outcrop of greenish gray, fine & medium grained dioritic material. There is a lot of variation within rock body. There are very few mafics ~10%, no quartz visible. Rock is hard & competent. Sampled

JOINTS:

@ 10'

II 64° 66° NW plane, smooth 1' to 3'

III ? 295° 58° S plane, slightly rough 3'

I 322° 69° NE plane, smooth 3'

@ 24'

I 338° 64° NE plane, smooth

- vegetation covers ~50%, difficult to get spacings on the joints, anyway the outcrop is blocky

@ 34'

Higher concentration of mafics, 30-40% in this diorite. Fine to medium grained Sampled.

- material changes to a talus slope. Angular blocks 1'-2' vegetation covers.

@ 79'-93' green-gray fine to medium grained ~10% mafics, similar to material at 10'. Rock ribs which continue upslope to §2-117.

82' I 328° vert to 86° SW Slightly curved,
smooth 2"-1.5"

345° 60° SW plane smooth 1'-2'

II ~~III~~ 068° / 50 to 81 SE

curved, rough

sp 2'-3' highly variable

80° @ 80° N plane, smooth

6" to 1' locally

III 305 / 51 NE

pl, sl rough

sp 3"-3' variable

III 357 / 90-80 E Forms 16' wide

pl, sm

rib

sp ~ 6'

W82-117 354° 36° up 51.5' 47

@ 70' went upslope to a large outcrop
with a western end connected to the
ridge @ 79' - 14 on the base-line.

Outcrop is 20' high 83' across; to main

ELEV. base of rock cliff gully

1802' @ 3' @

11716

Rock is a greenish-gray, fine to medium
grained dioritic rock. Fresh to slightly

weathered, hard to very hard, massive,
competent. Few mafics visible

JOINTS:

I 295°

80° S face of outcrop

plane, slightly rough.

6" to 10' aver. 2'

III 10°-20°

vert-75° W curved, smooth

Forms face of gully; 1' to 5'

IV 320°

10° NE plane is irregular,

smooth, discontinuous

6" to 3'

III 280°

55° N; plane is smooth 4" to 4'

aver. 2'

IV 30°

12° N plane, smooth

1/2" to 5' aver. 1/2"-6" locally

6' zone, fractured; other joints

are also closely spaced

T' = 6' below T on a drec

T' - 11 33'

284° 4° dm

U ends the outcrop of 82-116

before the outcrop continues across

the gully T. L = 128'

From T'-U rock exposure area. 15' high
 - On 92' from S to T to 4' on T'-U
 there is a gully.

Rock continues as a greenish gray
 fine to medium grained diorite. Matrix are
 fine to vfg. size. Rock is hard, competent.

WZ-117 U

WZ-117 U

Tb Major 297/81 NE. face of outcrop
 Pl, sm, approx. sp. 2.5 ft

IV 085/37 S dip of hill
 pl, sm
 1.5 - 3 ft

III 342/79 E.
 pl, sm
 sp 6 in - 2 ft

MINOR

Ia 318/71 NE
 sl. cov. sm.
 2 in - 1 ft

III 10/90

pl, sm, continuous
 sp 3 ft

WZ-117 (continued)

82' long 292°

- outcrop ends at the gully
 ~ 25' across to bedrock on
 d/s side of gully.
- this outcrop at 0.0', the face
 resembles the slide blocks on
 the opposite side of the gully.

@ 75' from R"

WZ-117b VI 70° 85° SE outcrop face
 plane, rough, 3'
 locally

I 305° 25° SW plane, smooth
 2" to 3', rk is spalling from

III 15° vert- 85° W plane, smooth
 2" to 5' - spacing is
 highly irregular, joints are tight

W82-117 ✓

@ 61' open joint, 4" to 6"; soil

II 55° 86° NE plane, rough

- prominent sub-horizontal joint ~ 15' above

IV 297° 9° N-NE plane to curved smooth 1' to 3'

TV 49° 41° SE plane, smooth 3'

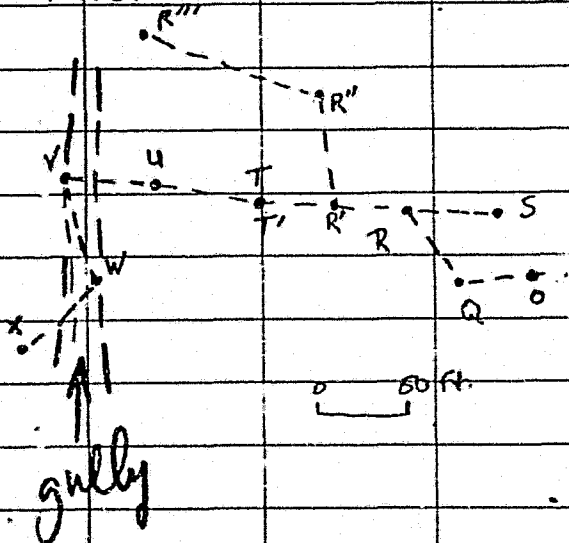
@ 37' joint

III 350° - vert plane, smooth open
1" to 4" soil filled, 2" to 7"
- generally 7'

N
↑

PLAN VIEW

LAST FEW STATIONS



U to V 28 29' 276° 16° du

W82-118 (V) 1719' 1753' @ 5 50

Yellow orange to orange breccia
gouge. Rock fragments up to 5" in
diameter, angular, fractured rock.

Gouge is a silty clay, some sand
non plastic to slightly plastic, 308° 72° N

Green-gray fine to medium grained diorite

ELEV 1719' 1753' @ 5 50

- elev of gouge zone & base of rk
exposure in gully, up to 15' high

Mafics comprise 10-15%

Joints - in bedrock in gully

IV 285° 35° S plane to sl irregular,
smooth; 1' to 4' axis 2'-3'

III 355° vert, plane, smooth; 1'-2'

II 295° 50-60° N plane, smooth;
1' to 2'

K82-2, 21 305° dipping d/s

K82-2, 22 rock outcrop close to
moderate close jointing in gully

Rock in gully is very hard, competent
As a rock mass it is not very competent
because of closely spaced joints, some open
joints

K 82-2; 23-25; gauge zone

V-W 88' 59' 167° 40° dn

V 88-119 1709' @ 6°

1674 east side of gully

- highly oxidized & fractured outcrop

light gray, fine grained diorite

Matrix 15-25%; no matrix visible

Rock is fresh to slightly weathered,

Hard. Fe staining on all joint surfaces

penetrates the rock surface. Rock outcrops
half way across the gully here, 5' high

JOINTS:

IV ~~305°~~ 305° 55°-65° SW
plane, smooth; 1'-5'
aves. 3'; dips towards
river

II 60° 85° NW plane, smooth
4"-3'; ave. 1'

16 295° 80° S to 80° N curved,
smooth; 1/2" - 6"

Zone, highly fractured is 50' wide

W-X 57' 55" 230° 28° dn

Flagged tree, pick-up from here
at a latter date. West side
of gully

1686' @ 6° @
1651

Waters

2291' @ 6° @ 60°
2260

The gully which we finished our traverse
in, needs to be looked at in more detail.
Should be able to pick most of not all
E-W shear/fracture zones with reasonable
confidence. If there are several, could
it be all one major shear zone? Of
interest today was the high amount of slope
covered by talus, (2) 20' wide gouge/breccia
zone, (3) roughly east-west joints dipping
out of the hill.

Traverse
plotted 3/23/92
NW

Geology
Notes 5/21/92
NW

8-5-82

It's a partly sunny morning. Will continue working in the gully which was started yesterday in the downstream portal area. Will tie in the end of that traverse with a survey control point. The gully will provide a good X-section of any E-W features.

Watana

2260' @ 6³⁵ @ 48°

Started morning by working with surveyors & brushers in the Fins area. UP-5 was set up in the Fins. UP-1 was located for the surveyors & brushers. Will set-up another LASC # to tie into UP-1, can't see the knob. UP-4 can be tied in with LASC #1

Waiting on help to take us to Friggkuster area.

ELEV. OF DP-1

1491' @ 12⁰⁵ @ 72°

1457

DP-1 = A

- proceeding up the gully we cycled on yesterday

A-B

37'

115°

king.

B-C

75' 61

8°

35° up.

WBZ-120 (C)

Outcrop on east side of gully, also a small exposure on the west side but is not exposed continuously across the chute, is covered by talus.

Green-gray medium grained diorite. Mafics comprise 25-30% to 3% fine biotite and hornblende primarily. Hard, competent. Mostly covered by vegetation & talus (thin veneer).

ELEV. mid-sect of outcrop.

1532' @ 12³⁵ @ 70°

JOINTS: from west side

III 0° $85^\circ E$ parallel to trend of the gully. $1''-2''$ aver $6''-1'$ plane to sl. curved, smooth to sl. rough. Half are open to $1/4''$.

IV 275° $30^\circ S$ plane, smooth $6''$ to $3'$ aver. $1''$;

I 305° $25^\circ N$ plane, smooth $1/2''-18''$ aver. $6''-12''$; some are open to $1/4''$

II 50° $75^\circ NW$ plane to sl. curved, smooth, $1'$ to $3'$; discontinuous

- $5'$ below, $7'$ higher, goes across the gully

C-D $29'$ 20° 14° 46° up.

- rock is exposed just upslope on the east side $20-25'$ across, $10'$ high. Diorite is blocky, good for joints

JOINTS

III 14° $88^\circ W$ plane, smooth $3''$ to $1.5'$ aver $1''$

I 295° $88^\circ S$ plane, smooth $3''$ to $2'$, aver. $1'-2'$

IV 340° $30^\circ SW$ plane, smooth $6''$ to $3'$; $1'-2'$

D-E $56' 48$ 345° 30° up

U82-121 (E)

Bedrock exposure across the center of the gully in a stepwise fashion. Very thin talus in the chute to this elevation. RL starts $5'$ below and is $8'$ higher. ELEV. $\sim$ midpt.

$1587' @ 108^\circ @ 71^\circ$

Green to green gray, medium grained diorite. Same as at 82-121. Rock is very hard, competent. Exposure is $20'$ across

Joints

II 295° $76^\circ S$ face of outcrop plane, rough; $1'$ to $3'$

IV 300° $40^\circ S$ plane to sl. curved, smooth $1.5'-3'$

I 50° $30^\circ E$ plane, smooth $5''-2'$ aver $1'-1.5'$

III 10° $80^\circ E$ plane, smooth $3''$ to $4'$ aver. $2'$ half are open $1/2''$

E+F 60' 45 53° 41° UP

W82-122 (F)

OUTCROP is on the east side of the gully, it is approx 35' across & 12' high. It is not exposed in the gully, as it is base → ELEV. 1032' @ 132° @ 71° covered by a thin veneer of talus.

The rock type varies quite a bit. The rock is a green diorite with fine grained & medium grained zones. Mafics average 20-30% - there is a small felsic dike, fine grained, light gray, 10-15% quartz, ~10% mafics. Some medium grained feldspar phenocrysts are iron stained, ~10%. Dike has an irregular subhorizontal trend to difficult to get a measurement.

Dike is highly oxidized, close to very closely spaced jointing, tight contacts.

Felsic dike on east side of outcrop, 2 in wide, irregular orientation possibly vertical, tight contacts.

JOINTS:

III 006/68W
plain, smooth
sp 1-2 ft

IV 040/26NW
plain, smooth
sp 6 in - 3 ft; av 1 ft

IV 055/43SE
plain, smooth
sp 2-3 ft

IL 288/80N
plain, smooth
sp 2-3 ft

III 347/70NE
plain to sh. curved,
rough
sp 3 in - 3 ft, av 1 ft
plant open

F-G 78' 67 340° 31° UP

- yesterday's end point, X
flagged tree

G-H 34' 34 ⁹⁶
~~274~~° 'horiz.
width of gully is 28' of the 34'

W82-123 (H)

Bedrock is exposed on the east
side of gully & part way across the gully
~ 10'

Shear/alteration (?) is ~ 10"
wide of a silty-sand with two 1" zones
of sandy clay → moderately to highly
plastic, is a light yellowish gray.
Silty sand is 30% silt, rest is
fine grained sand - yellow-orange
Shear zone is 2' wide, very closely
spaced joints. Orientation of
295° 68° N

Photo K82-3; 8

POINT:

Tb 305° 70° S plane smooth
face of bedrock in the chart

- the shear zone could dip in the
same direction as the 305°
SPT.

H-I 82' 65 4° 38° UP

- continuous bedrock exposed to this
point then a small crack in exposure
until a little farther up

- rock is almost continuously exposed
on the east side of the gully for this
distance

- last 5'-6' horiz. is shear zone
Rock is highly fractured, pcs. generally
~ 4". Orange silty sand, may
in part be altered. Rock is oxidized
Orientation

290°-295° based on bedrock exposure
on the west side of gully

- estimate dip 70° N (?)

ELEV.

1736' @ 33° (at 72°
1695

- bedrock starts on west side
& continues up slope past
upst. lays STA V.

I - J 51' 43 332° 32° UP

J = yesterday STA. V.

Shear is

305° 65° N on the east
side of the gully

J - K 100' 64 345° (est) 50° up

- adjacent, 15' to the west side
is a possible location of a
shear. No rock exposed

Max width 8' to 10'. Lined
up with a bench (no rock
exposure) on the east side
(i.e. on yesterday's outcrop
base line R'' - R''') the
orientation would be between
295° - 305°

- bedrock is exposed continuously
from here on up

K - L 40' 24 352° 43° UP

- at bedrock exposure on west side
of gully, gully is 15' wide

green, medium grained quartz diorite
Mafics = 20-25%. Quartz = 10%
fine grained inclusions of diorite

within, up to 3'. Fresh, hard,
competent, very blocky. Almost
all joints are open, loose blocks,
in fact right over our heads!

32° 33° JOINTS?

II ✓

265°

65° N plane smooth

6" - 2' over 1'

open to 3/4"

III ✓

305°

85° S

calcrete coating
plane smooth, open to 2'

2' - 4'

III ✓

10°

85° E

plane, al. rough
face of outcrop; 1' - 2.5'

open to 1/4"

IV ✓

20°

35° E

plane, smooth

2" to 3'; over 1' - 2'

open up to 1/2"

L - M

20' 23 4°

39° UP

adjacent to bedrock

W82-124 (M)

Near the top of the gully, rock is sheared, very blocky & loose throughout the exposure on the west side. Outcrop

1895' @ 506 (2 67°)

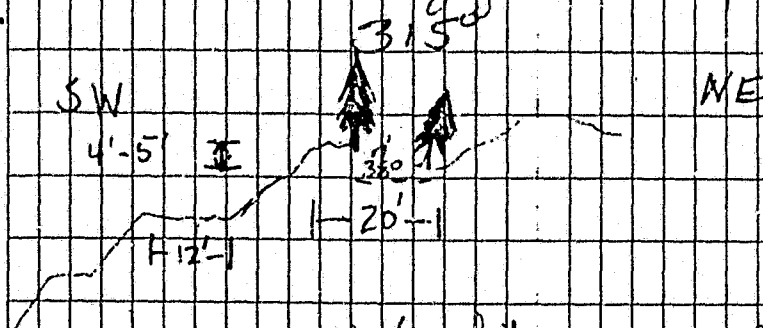
visited & mapped last year. Could the east-west shear be connected with the slump blocks adjacent to us downstream(?) If fact the loose blocks could be a function of. What is holding up the rock here ?? Stability problems!

M to N 82' 61 0° 42° UP

- from here to BH-2 will be along last year's traverse
- gully is wider here ~35-40', filled with large blocks of talus

N to O 63' 61 250° 16° UP

- up on to the west side ridge. Loose blocks continue for 58' even up on ridge, until outcrop disappears. Opening up to 1' along 27-30° 80-85° SE
- edge of stain steps, oriented



- 40' white spruce leans back towards the uphill slope

O to P 100' 97 309° 14° UP

- stain step unstable block is now oriented 290°

P to Q 75' 74 244° chow 7'

Q-R 73' 62 238° 32° dn

R-S 56' 53 293° 18° dn

S-T 110' 104 254° 19° dn
E.W. 2

~~Transverse plotted 8/5/82 K.W.~~

Wataru

2305' @ 6° @ 65°

1260

~~Transverse plotted 8/5 K.W.~~

several E/W shears were identified in the route with an average spacing of 50' to 60'. Along with the south dipping joint set, these features will pose problems in the portal area. Dangerous working conditions during the afternoon

8-6-82

It's mostly clear and sunny, even straight days of good weather. Will make a roughly east-west traverse in the "Relict" channel/Borrow 'D' area at roughly the northern limits.

Wataru

2260' @ 7° @ 54°

Photos: C-4,5 ; D-2,3

1082-94B

Dug a small pit on the side of a small P. knob. The joint north of boundary of no. 10 is a thin layer of material and outwash. Material is a mostly sand. Gravel to coarse size, up to 10", mostly subrounded some subangular, comprise ~20% over seems to be 1"-3". On the sandy surface surrounding the pit are numerous gravel to boulder size material. Boulders 2414' @ 9° @ 63°

up to 3' generally $< 1.5'$. Generally they are subrounded, lichen covered, dioritic (gran). Pale yellow brown (tan) fine to coarse grained sand, mostly fine grained. Sand is almost uniform, poorly graded, damp moderate dense. Ice disintegrated cobbles (diorite) crumbles in hand. Est 15% fines.

UNIT C ICE DISINTEGRATION

W82-96

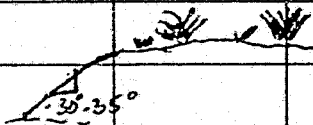
Along a NW-SE ridge curvilinear, concave to the SW. Has a 30° - 35° steep slope towards the NW. Dug a 3' pit.

SW

NE

Willows

much 8'-10'



0.0' - 0.7' Organics dark orange brown sandy silt

0.7' - 3.0' Pale yellow brown gravelly sand. Approx. 15-20% gravel to cobble size up to 10", generally subrounded. Primarily a fine grained sand with

a trace of medium & coarse grained. Poorly graded, damp, loose-moderate dense, 15-20% silt. Much the same as 82-90.

Will sample to compare to rig samples. Sand is fairly uniform.

2419' 10²⁵ @ 65°

UNIT C ICE DISINTEGRATION

W82-96 .. 100' from 82-91

Surface is disturbed, partially not regulated indicative of heaving. Large low mound 5' high max, 75' across x 150'. P.A.S.H. 3

0.0 - 1.1 Moderate brown peat

- surface is disturbed

1.1 - 2 Light fine grain, silty sand or sandy silt (light gray) fine grained sand. Very wet dilates quickly when thawed. Thaw - state = very soft, non-plastic non cohesive

1.7 is frozen

No visible ice, $w = 40\%$ estimated

US-97

Ridge or topographic high trends $\sim 95^\circ$ from this point. Have the pale yellow brown (tan) gravelly sand again. Same description as previously. Appears to be similar to southern & western limit of its distribution. Features may continue further north to just beyond the small pond.

ELEV. 2390' @ 11° @ 67°

US-98

Two pits. The first is on a small oriented 100° from this point with a max. relief on the order of 10'.

PIT # 1

Is approx 2.5' deep

0.0 - 0.4' Organics

0.4 - 1.3' Orange brown silty sand with gravel & cobbles within. Poorly graded

1.3' - 2.5'

Pale yellow brown (tan) gravelly sand with 15-20% gravel and cobbles subrounded & subangular average $\frac{1}{2}$ " - 2" sand is fine to coarse grained, primarily fine to medium. Poorly graded, damp, loose.

ELEV.

2349

@ 12° @ 68°

PIT # 2 is 7' down & 30' away

PIT # 2

- off stream shot hole

0.0 - 0.5'

Organics

0.5 - 2.5'

Pale yellow brown (tan) gravelly sand similar to above. Approx 25% gravel & cobbles, medium grained sand matrix

2.5' - 3.5'

Pale yellow brown (tan) gravelly sand. Gravel to cobbles occasional boulders (in surface of shot hole), up to 1.5' generally $< 6"$; comprise 40-50% subrounded & subangular. Fine to coarse grained sand, primarily medium. Partly graded, moist to wet, loose, $\sim 5\%$ fines.

W82-99

Dug a pit on the W-SW facing side of this topo high. Roughly 2.5' deep. Pale yellow brown (tan) gravelly sand. Gravel to cobble size comprises 20%, primarily subrounded; some subangular. Fine to medium grained sand matrix with some medium grained, trace coarse grained, 10% silt(?). Damp, loose, poorly graded. Much like all the exposures seen today. Upper 6" is a brownish orange, oxidized soil. Cobbles up to 7", aver. 1" to 2"

ELEV.

2286' @ 2²⁶ @ 7¹¹

- pit is 3' lower

UNIT C ICE DISINTEGRATION

W82-100

Pit, 2' deep. Pale yellow brown, gravelly sand. Gravel & cobbles comprise 40-50%, up to 8", aver 1" to 2", subrounded to angular, mostly subangular. Fine to coarse grained sand, primarily fine grained. Approx 5% silt. Damp.

loose, poorly graded. Similar to that which has been seen all day except there is a higher percentage of gravel. Pit is on a small topographic high next to the lake.

ELEV. 2234' - @ 3⁴² @ 72⁰

UNIT C ICE DISINTEGRATION

W82-201

Sinohole on a seismic line, 100' back with faded pink flagging is a stake. Dug a 2.5' exposure. Moderate yellow brown (tan when dry) gravelly sand. Gravel to cobbles occasional boulders comprise 15% subrounded, largest boulder $\approx$ 2.5'. Matrix is a fine grained sand with some medium & coarse grained, 10% silt. Damp, loose, poorly graded. Sand is uniform. On first gently sloping surface.

ELEV. 2238' @ 4²⁸

Is on seismic line 80-2 81-14
200-300' from gap

US2-202

Fin. (brown/orange/tan) gravelly
sand. It is the same that has been
seen all day. Mostly fine grain
sand with trace of some medium
coarse grained sand. Approx to be
a cobble/boulder layer just beneath
the vegetation mat. On the
small ridge oriented roughly
approx 200 m from camp
LEV. 2275' @ 5°⁰⁰

2258' @ 5° @ 1.5°

8-7-82

It's a mostly cloudy day, looks like
it will rain today. Will finish up surficial
mapping between Tsuena & Dentman this
morning except for possible spot sketching
after more drilling has been completed.

Watawa 2260 @ 7°³⁰ @ 48°

Photos: 4-3-32, 33; 2-7-1, 3; B-6

US2-203

On SL82-B on ^{edge of} drainage to Tsuena
Creek. Dig a 4-inch foot pit.

0.0-0.5' Organics. Oxidized soil (A)
gravelly sandy silt, orange to
orange brown.

0.5-3.2' (Light gray) Pale yellow brown
gravelly sand. Gravel & cobbles
comprise ~ 30%, unrounded, generally
less than 2", up to 6". Fine to

coarse grained sand, primarily
fine grained sand ~ 10% fines
Damp, loose, poorly graded.

Sand is mostly uniform. Several
cobbles & boulders up to 2.5'
along break in slope. Approx
height from trough to crest

ELEV. 2141' @ 55°

OUTWASH (2122')

W 204

STA is N-NE of a lake, Ridge is at
285°, ~ 18' high (ELEV @ top)

Moderate yellowish brown, gravelly
sand. Gravel to cobble size comprise
20-25%, subangular to subrounded
generally < 6" in pit but there are
boulders up to 4' across along this ridge
crest. Fine to coarse grained sand, primarily
a fine grained sand. Estimate 5-10%
fines (?), damp, loose, poorly graded

ICE DISINTEGRATION UNIT C

ELEV.

2260' @ 90° @ 55°
(2251')

Morphology - Knife & settling morphology
lake to the north has scattered boulders, goes
along its shore.

Material appears to change to a pale
yellow brown (??) more silty further down
in section

Sampled - more silt content?

10' Gravel
5' Sand
3' Fine

W 62 205

At the top of the ridge which is
concave to the south, ridge is ~ 8' high
and several boulders in foot of it. Ice
disintegration top dies out in the east
& southeast

Pale yellow brown (lt gray/tan) gravelly
sand. Gravel to pebble size, comprise
25-35%, primarily subrounded, up to
10' in diameter in pit generally < 3".
Fine to coarse grained sand, primarily fine
grained sand. Damp, loose, poorly
graded

Based on morphology the depth to the
till should not be that great

(2378')

ELEV. 2417' @ 10¹² @ 61°

ICE DISINTEGRATION UNIT C

Morphometry - steep side to south
 gentle to the north

- many large boulders scattered along the surface, especially along the flanks of the larger hummocks

Dug a pit into one of the larger hummocks. There was much more gravel & cobbles, its flanks were covered with many boulders in the 2'-6' range but some up to 10' across. All are white / granodiorite. Matrix seemed to have more fines than usual

~ 25° S

~ 15° N

- will now do photo work from clippers

W82-206

Flow exposure oriented 305° on a 16° slope. Dark yellow brown gravelly sandy-silt. Gravel to boulders, comprise up to 35-40%, up to 1.5', generally 1" to 4", subrounded, many are striated, some are polished & faceted. Sand probably comprises roughly 20% (of the remaining 60%) fine to coarse grained sand, primarily fine grained. Damp, firm, compact, non-plastic.

Sampled (1928')ELEV. 1991' @ 11⁵³ @ 68°

TILL UNIT G

W82-207

Small outcrop at approx 2020' (helo)
 Most of the outcrop is loose. It is a green-gray porphyritic rock. It has an aphanitic groundmass with plagioclase phenocrysts with occasional shaly phenocrysts. Phenocrysts up to 1/4". Hard, consistent. Andesite. Porphyry.
 Weathering rind 0.5 cm.

W82-207 4330' @ 123° @ 65°

155

BH-12

- flow was 4.25 gals/min.
- the recent weather conditions have been almost no rain for the past eight days which was preceded by a great deal of rain over a span of 2-3 weeks.

Had some rain late in the day only one shower in the morning. Plotting of data in the afternoon.

8-8-82

It is sunny & clear. It is sunny to the east, upper reservoir. WICK work in office today.

- plotted stations for in & out days
- plotted 1-55-82 ALONG TOWNSEND CREEK

8-9-82

It is mostly clear and sunny. In the morning, it is in the morning. It is in the morning.

- plotted x & y coordinates
- summer finished shooting in the initial at mid-day.

3-10-84

No. 4 cloudy morning with
celcius at 5.000 - 6.000. Sun
coming for. Will continue
mapping in the downstream portal area.
It's a cool morning.

Watana 2260' @ 64° @ 115°

- Will start a traverse from DP-5
working downstream A=DP-5
Along SL82-D

1556
DP-5 1564' @ 74° @ 52°

on a large bouldery talus slope
with boulders up to 6', all at
this level are moss covered, some
scattered birch trees. Talus
appears to be relatively thick.
Gravel is 3' to 4'

153
A-B 153' 98° horiz
- first 100' thick talus slope
very blocky, main part.
- 100'-153' not as thick, more
trees, not just moss, covered on
boulders.

97
A-C 100' 275° 14°
- first 45' main thick talus
relax
- 45-100' thin talus slope with
moss covered, many more trees.

C-D 100' 100' 287° 5° dip
@ 30' talus slope steeper, becomes
scattered boulders, still talus
but not a main slope/chute
@ 65' and 6' lower in elevation
a spring exits from the slope
as noted earlier when doing
the layout of the seismic line

150
D-E 100' 284° horiz
0'-100' Talus slope mostly
moss covered. Boulders appear
to be in the 2'-3' range (65-100')
48'-65' mostly very scattered
boulders

E-F 83 302° 15° UP

F = DP-4

1572 @ 8 1/2 @ 53°

- talus slope continues across top
relative to thin. Seems to be
of no talus.

- just above seismic line

F-G 52' 46 241° 27° dn

- back on seismic line

- talus boulders

G-H 100' 284° horiz

- still talus boulders 95-98%
now covered

H-I 36 40' 206° 26° dn

WSZ-125 (I)

Small outcrop, appears to be part
of a small bench which trends parallel
to slope (105°) approx. N. G

ELEV. TOP OF OUTCROP

1546' @ 9" @ 54°

1526

OUTCROP is roughly 10' high
20' wide. Greenish gray, fine grained
granite. Approx 10' to 20' thick.
In place some coarse grained green feldspar.
Trace of slight weathering, hard, competent.
Weathering to mudstone along joints. Outcrop
may have slumped somewhat, loose.

JOINTS:

~~10~~ 355° 65° E plane smooth
1" - 1.5'; aver 4" - 6"
50% and open 1/8"

11 290° 60° S plane to sh. curved, smooth
6" to 2' (?)

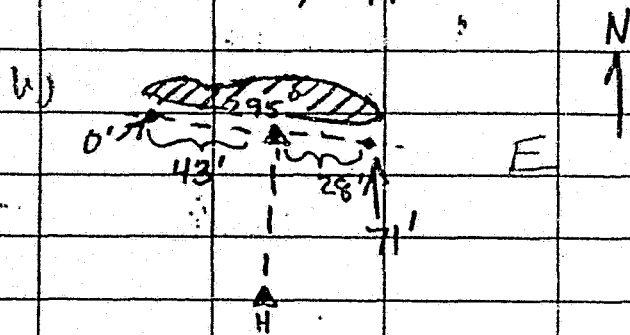
12 270° 80° S plane to sh. curved, smooth
2" to 1.5'; aver 1" - 1.5"

- small fracture zone, close to very closely
spaced, along the 355° joint, 1.5' wide

H-J 110' 5° 26° UP.

W82-126 (J)

OUTCROP, large, 10' to 15' high
oriented 295°, approx. 72' long



ELEV. At Base of outcrop

1596
1621 @ 95° @ 57°

At the east end of the outcrop, talus
slope from up above covers any outcrop.
light gray, some green, fine and medium
grained quartz diorite. Quartz ~ 10%,
mafic 15-25% - mostly fine grained, ~10%
coarse grained green feldspar. Outcrop
is iron stained. Fresh to slightly
weathered, hard, competent, heavy
iron oxide staining. Generally massive

JOINTS:

@ 63'-68'

III 10° 65° E plane, smooth; 1'-1.5'
aver. 1'

-face of outcrop

II 280° 85° N plane to sl. curved, smooth
aver. approx. 1'

IV 15° 35° W plane, smooth 1' to 3'
aver. 2'

@ 68'-71'

3'

-fracture zone along the 10° set,
spacing 1/2"-6" aver 2". Very
closely spaced jointing. Fe staining
increases towards end of outcrop.
Rock is loose, open to 1/16"

@ 43'-55' loose blocks on outcrop face
slumping(?) physical weathering

@ 28'-29'

355° 85° E plane to sl. curved
smooth 6" to 1.5' ? est.

317° 58° SW plane smooth
6" to 3' est.

JOINTS @ 12' - 16'

IV 6° 22° W plane, smooth
2' to 3'

150° II 52°-72° 84° NW plane, smooth
6" to 2' aver. 1'

15 292° 70° N face of outcrop,
plane, smooth 6" to 2'

IV 3° 41° E plane, smooth
1' to 3'

0.0'

OUTCROP ends abruptly at west end.
There are many 1" to 3" oxidized fragments.
May be a fracture zone along the 10° set,
but there is nothing in place.

Photo K82-3;9 (fracture zone
K82-3;10 (blocky part of outcrop
east end

Back on seismic line

100

H-K 100' 285° 4° dn
talus boulders are more concentrated
and a thicker layer occurs @
80'-100' & continues downstream.

63

K-L 63' 278° long
0-53' Relatively thick talus slope
53'-63' Bedrock exposed off & on
again, mostly covered by vegetation

41
L-M 42' 267° 15° dn
DP-3(M)
ELEV. 1537
1572' @ 11° @ 56°
- started to rain

W82-127 (M)

OUTCROP roughly 15' high, 62'
long to DP-3 and extends beyond in
a downstream direction. Greenish-grey
fine & medium grained quartz diorite. Quartz
& mafics are fine grained. Slightly weathered,
iron staining has penetrated much of the rock.
Hard, competent. On a steep slope,

JOINTS

II 70° 80° S plane, smooth, forms
one face of outcrop. Est. 2'

III 0°-20° 85° W - 85° E plane, smooth
8" to 3' est. Est. aver. 2'.

10

1h 310° 65° NE plane, smooth; 2"-3';
 . are, est 2'.

1h 300° 65° SW plane to sl. curved,
 smooth, face of outcrop

M to N 70° 280° 6° dn
 - @ 29' bedrock is almost continuously
 exposed

W82-128 (N)

large outcrop which averages 20'-30' high.
 Highly fractured, moderately weathered/altere

ELEV. @ base of

1574' @ 1203 @ 56°

intense FeO staining on joints also penetrating
 Generally moderate hard to rotten - as in
 exfoliation (thud!). Overall the face of
 outcrop is rotten. Quartz diorite, orangish
 gray, fine & medium grained. Some carbonate
 staining along the outcrop face, occasional
 sulfides all of which may be indicative
 of hydrothermal alteration.

JOINTS:

IV * 280° 35° S plane, smooth; FeO stained
 & discontinuous talc-like coating
 greasy feeling; 3" to 2';
 are 6"-1'

II 80° 60° S. plane, smooth; Fe stained
 spacing of 1' - > 2' discontinuous?

III * 0° 85° E to 85° W plane smooth
 1/2" to 3' are 1'-1.5'

(2) local zones of fracturing, E-W shear
 6" wide 5' apart.

IV * 325° 85° SW plane, smooth 1" to 1'
 are 6"-1', for ms face

280° 70° N plane, smooth Fe staining
 may be discontinuous. Spacing
 is 4" where visible.

50° 70°-80° NW plane to sl. curved
 slightly rough, discontinuous
 8" to 2'

Fracture zone subparallel to face
 between 300° & 325°

Photo K82-3, 11, 12

52

N to O 54

305°

17° UP

O - O' 28' 305° wing
- outcrop exposure ends at C'

at O, on 82-128

Light greenish gray fine to medium
grained quartz diorite generally fresh
w/ zones of slight to moderate weathering.
Mostly hard & competent. Trend of
outcrop is 290°.

82-128a

JOINTS:

Ib * 290° 80° S plane, smooth to
slightly rough; free of outcrop
6" to 1'.

III * 0° to 10° 80° E plane, smooth
fracture zones associated with
2" to 3' over 1'

Ic 315° 85° SW curved, smooth
6" to 1.5' locally

II 50°

75° SE plane to sl. curved
smooth 4" to 2' over 1'-2'

IV 40°

10° SE plane to sl. curved,
smooth 2' to 4'

- orientation changes but not dip
- mpt if common.

OUTCROP 82-128 is 120' long (?)

Fracture zones 0° at 46' & 54'
along N to O.

@ 46'; width is one to three feet
Close to very close fracturing, 1/2" - 6".
Loose iron oxide, sl. weathered
- possible local shearing

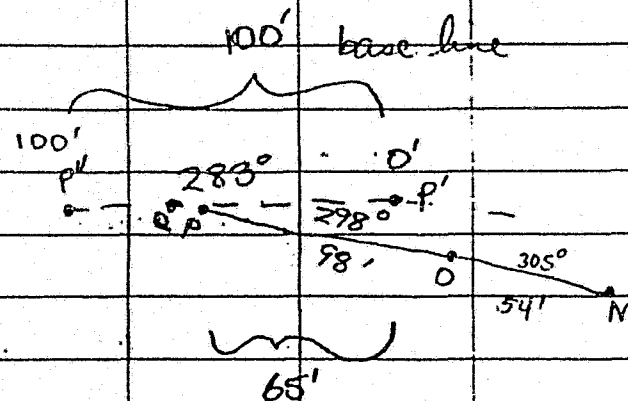
@ 54' fracture zone as result of
intersecting joints. Iron oxide
staining slightly to moderately
weathered. Spacing is close
to very close; 1" to 8"

O to P

98'

298°

18° VP



W82-129

Large long outcrop, continuous from the last station, averages 20' - 35' high.

ELEV. base of exposure

15' to 37' @ 2° 35' @ 56°

Bedrock is exposed to thinly covered beneath us.

Quartz diorite; orangish, greenish gray fine to medium grained. Quartz is fine grained, mafics 10-15%. Hard to very hard, competent, slightly weathered. Sulfides ≈ 5%. Blocky with close to moderately close joints.

- 30' Local discontinuous zones of hydrothermal alteration. Rock is moderately hard.

- 10' - 15'

JOINTS:

III * 15° 65° W plane, smooth 2" to 1.5', aver. 1'

IV 295° 65° N plane, smooth; face of outcrop; 4" - 6" and greater

II * 60° vert. plane, smooth 6" to 3' aver. 1'

- at 38' - center of gully which trends upslope. Difficult to dig in

Fracture zone in gully

340° 80° NE iron oxide staining 1/2" to 2"

- moderately hard. Silt-veined layers in joints ~ 1/16" thick possible gouge (?)

- 2' - 3' wide

@ 40' Dike - aphanitic, light magish gray, slightly weathered, hard, 16' wide. Orientation 335° vert w estimated. Joint spacing w/i is about 2'.

@ 30'-38'

JOINTS:

1b * $290^\circ-297^\circ$ $85^\circ S$ $85^\circ N$ plane to sl. curved smooth 1' to >5' (?)

average est 2'

III * $335^\circ-350^\circ$ $75^\circ E$ plane, smooth 2" to 2', aver. = 1.5'

II 60° $75^\circ SE$ plane, smooth; forms face of outcrop 6" to 3' aver. 1' to 2'

III * 0° $75^\circ E$ plane, smooth; 1'-2'

IV * 65° $23^\circ SE$ plane smooth 4" to 2'

- Local discontinuous hydro alteration zones are along the 340° act - general between outcrop & buried fracture zone

@ 68' Rock is mostly fresh. Small fracture zone, close to very closely spaced. Width is 6" to 8" 330° $85^\circ SW$

68' - 98' Rock isn't very good. Slightly to moderately weathered, moderately hard. Heavy carbonate staining. +40% air loss to the west. Joints are generally very close to closely spaced.

52-107' JOINTS: - 75' - 98'

III * 10° $80^\circ E$ plane, smooth 1/2" - 1" aver. is 4"

1b * $290^\circ-310^\circ$ $70^\circ S$ plane to sl. curved, a outcrop face 1" to 1'; 0.5' to 1' average

II 65° $80^\circ SE$ plane to sl. curved, smooth face of outcrop; aver. 1' to 1.5'

IV 332° $31^\circ SW$ to 315° $34^\circ SW$ (lower) plane, smooth 1" to 1', 4" aver. - same as subhorizontal shear above which the joint spacing is closer. Shear averages 1' wide heavy carbonate staining

(a) 96' Possibly a major shear up to
3' wide with estimated orientation
of 302° 85° SW (based on
adjacent outcrop

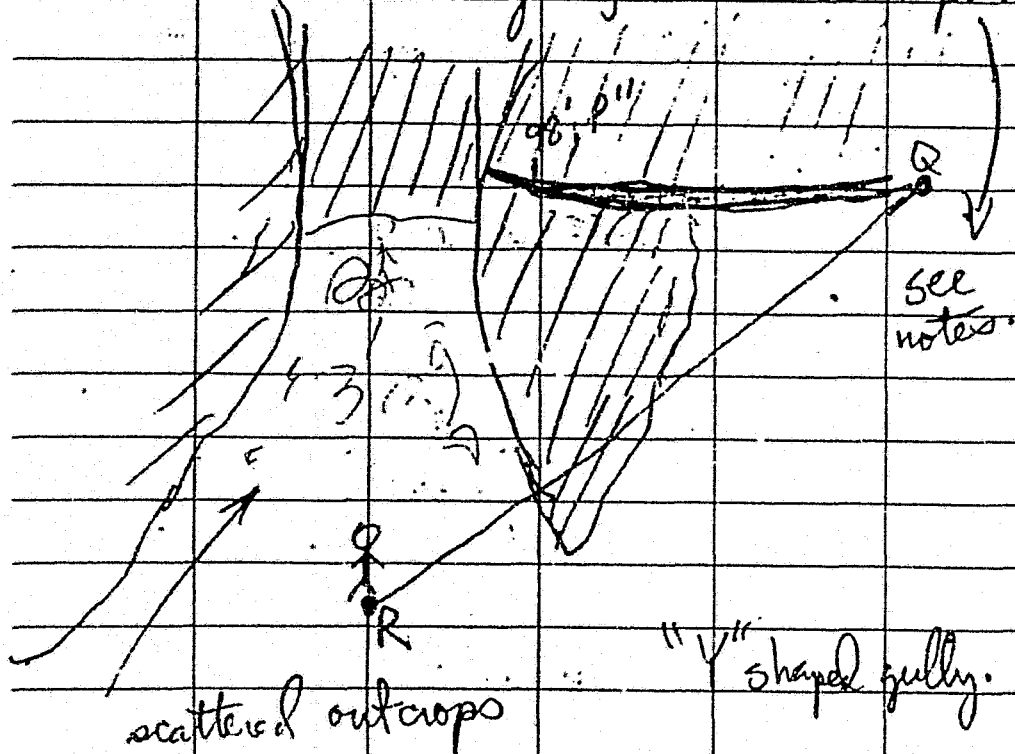
P-Q	6'	283°	horiz.
Q-R	48' 63'	251°	41° dn

ELEV.

1614' @ 4⁴² @ 57°

- continuation of same outcrop above.
Currently near base, cliffs continue
for 60' up.

- this point is directly beneath a
15'-30' wide gully. We were last year.



- west side of gully, oriented 300° could
be into P¹¹. ?? Got to be a
shear or fracture zone. Trace this to
the downstream gully.

- Outcrop above is blocky with closely
spaced jointing, some very close.

R-S	99' 100'	268°	9° dn
-----	----------	------	-------

- continuous outcrop across slope.
At the end (S), schist is exposed
for roughly 50' above me and 12'
below.

- bed is in light gray, fine to
medium grained diorite (?) only
trace of quartz seen. Makes 25%
Rock is fresh to slightly weathered.

Fracture zone at 55' along R-S
5° vert. 1'-1.5' spacing
1/2" to 2" CO₂ staining
rock is moderately weathered.

57-129°
 POINTS @ 55'
 III * 355° 80°E plane, smooth
 2" to 2' aver. 1.5'
 I/2 * 290° 85°N plane, smooth
 aver. 1'
 I/6 * 295° 50°N plane, smooth
 2" to 1.5' aver. 1'
 II * 70° 75°SE plane, smooth
 6" to 2', aver. 1'
 I/V 275° 55°S plane, smooth
 - taken at 75'
 - 2" spacing in one spot
 - approx 30' above S, outcrop
 face is 85° 80°S, sl. uneven,
 smooth
 - rock is the green-gray fine to
 medium grained diorite,
 25-30% mafic, some coarse
 grained feldspar
 91
 S to T 100' 246° 24° dn

31
 T to U 37' 244° 34° dn
 U = DP-1
 ELEV of marker
 1546' @ 698 @ 53°
 1457.

Watanabe

2352' @ 732 @ 46°
 7260

Several fracture zones were mapped
 Also have two potentially large shear/fracture
 zones (2' to 3') but we were unable
 to determine this for sure. At 82-128
 rock was of poor quality.

Elevations & distances
 traverses KSW 8/22/82
 Geology Collected
 KSW 8/26/82

8-11-82

It's completely overcast, low ceiling. It has been raining lightly off and on this morning. Will do a traverse along the bedrock cliff in the downstream portal from DH-6, 7.

Wakana

2265' @ 6⁵² @ 48°

Around 11³⁰ began slowly clearing. Mostly clear @ 1³⁰

DP-6 (A) ELEV.

531648' @ 7⁵⁰ @ 50°

- talus extends 30' to 40' back toward DH-6, 7

A-B 100' 91 351° 24° op
- all on relatively thick talus

B-C 100' 92 320° 22° up

1182-130 (C)

SET-UP a 100' base line at azimuth 085°, 0' to the east. At 32' the line crosses (C). Rock cliff ranges from 10' to 30'

ELEV at C, base of rock cliff

1736' @ 9²⁵ @ 58°

Bedrock is a ^{greenish gray to} gray fine to medium grained diorite. Trace quartz (?). Mafics are generally fine to ^{to medium} grained and comprise 20-30%. Fresh to slightly weathered, hard, competent predominantly massive.

@ 33'-36' zone of carbonate staining zones of fractured rock with 1' to 2' moderately weathered, discontinuous - can't pick up a trend!

Joints @ 36-42'

II * 55° 85° SE to 85° NW, plane to sl curved; 1" - 1.5" aver. 6" to 1'.

16 * 300° 75° N plane, smooth 6" to 1.5" aver. 1'

approx. 385° 30° SW plane, smooth 1'-5' aver. 3'-4'

subhorizontal set, up to 10° dip,
generally discontinuous

(w) 72'

1.5 287° 88° SW plane, smooth
open joint up to 2", CC_3
staining

1.6 298° 75° NE plane, smooth
open $\frac{1}{2}$ " - 1"

II. 160° 85° SE plane, smooth
open up to 4"

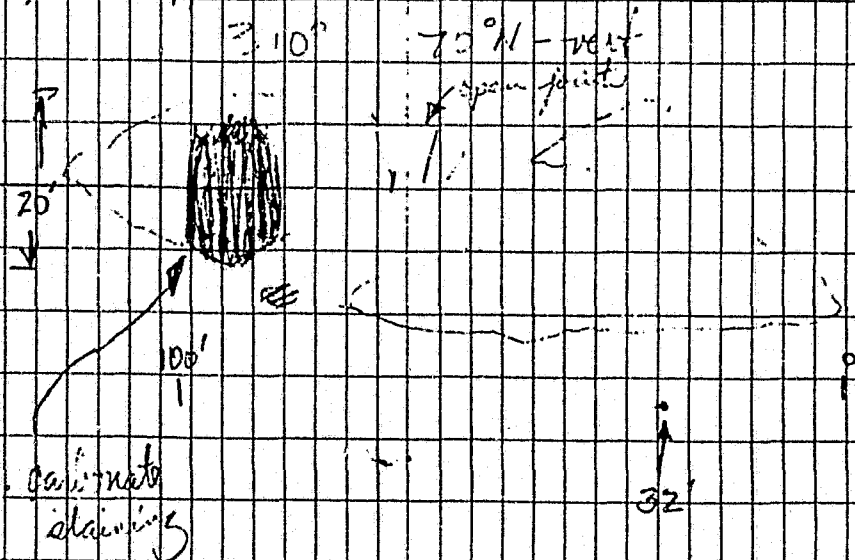
@ 88' - 95'

outcrop is hydrothermally altered
 CC_3 staining. Rock is moderately
hard and moderately weathered/
altered. Is either along the
 305° or 345° set.

@ 76' small exposure of highly fractured
moderately hard rock. Joints with
orientations of 310° , 345° and
 70° . Not sure which direction.

??

it follows has to be either 310° or 70°
It's probably the 310° , 70° set is unknown
Heavy iron oxide staining, minimum
width 2". Weathering is slight to
moderate with some friable rock
Clay filling along joint 345° , 70° W
up to $\frac{1}{2}$ " wide; moderate plasticity
Also a thin clay filling in the 290° - 310°
set. All joints are very closely spaced
Approx. on 310° set



18
C-D 92' 222° 32° du
44' apex of talus to 86' d/s edge
if

15

D-E 23' 188° 49° dn

E-F 10' 34° horiz

F is east end of base line for
82-131, 0.0'

W82-131 (F)

Base line set up, oriented 291° along
ELEV.

1671' @ 95° @ 52°

Talus is found along the base of the outcrop.
0.0' - 25' Outcrop is ~60% covered by
the vegetation mat

0.0' - 4.0' Rock is slight to moderate weathering
0° 75° E spacing is 2"-4"

Fe oxide staining

10.0' face of outcrop

285° 80° S plane, smooth

Fe oxide staining

12'-17' Fracture zone, with possible
12° 82° E plane, smooth.
old shear or highly weathered
joints, 1/2" wide Not many

through going joints, mostly fracture,
discontinuous

26'-40' Close to very closely fractured
strong north-south trend, discontinuous
All are tight. Probably just a surface
fracturing

JOINTS:

1.6 290° 65° N plane to sl. curved
smooth, 1'-2', discontinuous

FROM 44' - 85' massive cliff exposure
20' - 25' high. Greenish, light gray
medium grained diorite. Matrix comprise
15-20%. Very hard, competent, mostly
fresh only slight weathering. Well
defined through going joints. Trace of
silica mud quartz (5-10%)

JOINTS 67'-75'

11.4 10° 75° E plane to sl. curved, smooth,
1" to 10', aver. 4' to 5'
- one open joint 1/4 - 1/2"

11.4 290° 85° S face of outcrop: plane,
smooth, est. 2'

IV 295° 50° S plane, smooth
4" to 3', aver. 2'

minor joints

IV 60° 80° NW plane, smooth 2' to 10'
generally 10'.

- jointing is moderate close to width
85' - 110'

- outcrop decreases in elevation from
15' down to jbl at 110'

- jointing is close to moderate close
Rock is hard to very hard, fresh
to slightly weathered

5/2/31 JOINTS:

I 288° 71° N, plane, smooth
2" to 1' aver. ~1'

III plane to
sl. curved → 348° 87° NE; plane, smooth
2" to 1.5'; aver. 6" to 1'

II 70° 85° SE to 85° NW; plane to
sl. curved, smooth; aver. 1'

IV 20° 14° E plane, smooth
3" to several feet; generally
>1'

Start @ 9:11 from F
"G

100

G-H 100' 285° 4° up

- thin talus, vegetation mat covers
- bedrock 60'-70' distance - elevation
~15' elevation

97

H-I 102' 303° 18° up

- talus covered by vegetation
- bedrock is roughly 25' over to the
west

42

I-J 48' 45° 30° up

W82-132 (J)

Large outcrop is ~40' long
10'-15" high. Light greenish gray to gray
fine to medium grained diorite. Matrix
comprise 15-25%, fine grained, distinct hbl.
Very hard, compact, mostly fresh.
Outcrop has good parallel jointing. Point is
to the middle of the outcrop.

ELEV @ base 1745 @ 114° @ 56°

1757

JOINTS

II * 85° 85° NW plane, smooth
6" to 2' over 1'
- face of the outcrop

IV * 0° - 20° 55° W plane to sl. curved
smooth; 4" to 1.5', over 1.0'
subhorizontal dipping at 10° , average
spacing 2'; discontinuous

III * 0° 80° E plane, smooth
2" to 3", generally 1'-2'

J to J' 44' 269° horiz.

- edge of bedrock cliff, along the eastern facing side
- rock is light gray fine to primarily medium grained diorite. Hard to very hard, blocky, competent

JOINTS;

III 8° 75° W, plane to sl. curved,
smooth, 3" to 1.5', over is
1.0'-1.5'

IV 282° / 45° S
plane, smooth
sp 1-2'

IV ~ 290° / 14° N
planes, rough
sp 1 to 6 ft

I 076° / 85° S
plane, smooth
sp 1 to 2 ft

II - K 41' 244° 30° down
Elev. 1692' @ 12³⁴ @ 56°
1700

K-L 100' 283° horiz.
base line along the base of a cliff
just above DP-7

W 82-133 (K-Q)

Cliff exposure the S. side of
J'. Outcrop is up to 30' high, then
vegetation covers much of it in places. Fresh
talus beneath part of the outcrop. Rock

is a greenish, mostly light gray, fine to medium grained, ^{discrete} Some quartz
rock is hard to very hard

FRACTURE ZONE:

Altered, possibly also sheared @ 28' 2" wide with a silty sand material within 10° 70° W

which may be wash; 1' west & 5' east were closely spaced joints, heavy CO₂ staining feldspar phenocrysts have altered to clay, hydrothermal alteration(?)
Rock is hard to moderate hard.

JOINTS in the fracture zone

I 315° 70° N; plane & smooth 1/4" to 6", 1" & 2"

II 275° 85° N plane; smooth face of outcrop; est. 6"

@ 33'

II 80° 75° SE plane, smooth; 1'

the alteration/shear(?) probably pinches out upward and may be even downward. Don't see it in the bedrock exposure below

@ 38' some fresh bedrock

@ 48' - by a 10' width no bedrock exposure. If a fracture or shear yield stain zone out through here the orientation angular Fe₂O₃ would be between 277°-310°, with stained fragments. It likely being towards the high end (3) II Frac zone here it is about 8ft wide @ 310°

@ 53' minor local alteration - heavy CO₂ staining & feldspar are breaking down to clay minerals (medium & coarse grained x'tals). Rock is hard & competent except in a 6" wide zone trending 310°. In the zone it is moderately altered, moderate hard. Rest of rock is fresh to sh. weathered, hard.

JOINTS

I 310° 85° N plane, smooth face of outcrop; 1' and greater

III 5° 65° E; plane, smooth; 2" to 1.5'
aver. 0.5' - 1.0'

IV 255° 50° W; plane, smooth 1" to 2"
aver. 1.0' - 2.0'

minor set

71 65° 70° SE, plane, smooth, discontinuous
1' to 5'

From 65' - 86' not much rock exposed
≤ 10%.

At 86' rock is well exposed with a
large portion of the outcrop exposed
along a single joint face (302°/83 SW)

5' with sun face
@ 90' outcrop is roughly 15' high

@ ~110' outcrop is 25' - 30' high

- outcrop is blocky to massive
some good parallel jointing in
places. Rock is light gray, fine to
medium grained diorite. Hard
to very hard, competent.

133b

Joints

III Major 002 to 008°/70 E

planar, smooth

Sp 1 in to 1 ft, av 6" to 1 ft

incl jts in 5 ft zone, some discont.

1/4, sp 1/2 in to 6 in, av 1 in and 6 in

IV 025 - 030°/47 NW
plane, smooth
sp 1 in to 2 ft, av 1 ft

II 060/86 SE

planar, smooth

sp. 3 in to 2 ft, av 6 in to 1 ft

Locally Major

1a 330/80 NE CO₂ and hydrothermal
alteration

planar, smooth, local

sp 1 in to 6 in, av 2 to 3 in

rock is all to red weathered (thick)

Minor

IV 060°/39 SE

planar, all rough

sp 2 to 2.5+ ft

83

L to N 83° 284° ~ 5° up.

- at 26' begins a major joint face which
is parallel to the one at 86' along K to L

305° - 310° 79° SW, plane, smooth

It is the face of the outcrop, average

15' high. Have two faces with a spacing

(over)

L-M (DP-7) 60' 135° 20° down
 EL 1680 at 2:4 PM
 1699 Temp 62°

→ L-N continued

of 2.5'. Dike exposed on the face. Fine grained sugary appearance, light orangeish gray. 10-20% quartz, the rest is feldspar, fresh to slightly weathered, less than 5% malice. Minimum of 1' thick breccia along the outcrop face (305°-310°) seen on face from 26'-45'

1/1" @ 56'

JOINTS:

Ib 305°-310° 75° SW plane smooth
 6"-3'; aver. 2' to 3'

III 5° 75° E plane, smooth

aver. 1' to 2', a couple up open 1/2"

minor → 70° 80° SE plane, smooth
 6" to several feet

IV 20° 40° W & 70° W plane, smooth
 10' (?)

⑥ 85' typical light gray, mostly medium grained diorite. Very hard,

competent. Don't find the dike exposed here, it may pinch out or go up a 1.5' gully along the outcrop face.

N to O

36'

276°

horiz.

① 10'-15' Kink right trend down slope
 light gray, fine to medium grained
 diorite. Malice 15-25%, quartz 15-25%
 Fresh to slightly weathered, very hard
 to hard. Some penetrative Fe oxide staining

JOINTS:

III major { 5° 80° E plane, smooth to slightly rough; 1" to 2'; aver. 6"
 1/6 { 270° 80° N plane, smooth; 1" to 2' aver. 6" to 1'

IV minor 350° 5° E plane, smooth; 2'-3'

O to P 34' 311° 35° up

- line is roughly parallel to slope
 - pt O is next to end pt of SL-82-JB
 - continuous exposure along a major joint set 308° 75° SW which

started down below at 27' along N to O
 Rock is the greenish-gray, primarily
 medium grained diorite. Hard to
 very hard, competent.

P-Q

81'

15'

279°

67' 66

285°

8° up

82'

0.0 - 18.0' Loose rock, open joints

Jointing is close. Fracture zone
 12° 55°-85°W, 6" to 1.5' wide
 fracture is primarily along the
 N-S joint set. Spacing is 1"-2"
 the fracture zone is parallel and
 in places it cross cuts the N-S
 joint set.

Other joints:

- III 340° 80°W plane to sl curved;
 smooth; 6" to 1'
II 265° 70°N face of outcrop;
 plane, sl rough; 6" to 2'

@ 32' Rock is a greenish, mostly light
 gray, medium grained diorite
 - trend of gully, parallel to face, upslope
 is 320°, this parallels a joint
 set.

5-2-1336 - local fracture zone as a result
 of intersection of joints. No
 mappable trend. Some of the
 joints and the outcrop face have
 carbonate staining.

Joints in local zone:

- I 42° 48° SE plane, smooth; 1' to 2.5'
II 58° 86° NW " " 2" to 1'
III 330° 77° NE " " 6"
IV 273° 33° S " " 2"-6"

Strike varies a great deal,
 subhorizontal set

- IV 347° 45° E; plane, smooth 6" to 1'
 above — 265° 65° S " " 2'-3'

- gully up above splits 320° and
 20°, nothing found
 - rock may have slumped somewhat
 - some FeO staining

@ 58° fracture zone along the N-S
set; 8°-13° dip 70° W to 5° E
All are plane, smooth, some part
open. Spacing is 1" to 3", 1'-2'
width. It is a result of intersecting
joints

from 58' to 83'

Rock is a very hard, competent, massive
exposure except for a shear zone
75' with up to 2" of breccia & gouge
CO₂ staining & coating
0° 75°-85° W 3" to 1'
over 6"

Photo K82-3; 13, 14

Q = elev. 1770

ELEV. 1722' @ 55° @ 64°

Q-R 22' 192° 42° du

ELEV. R

1742' @ 60° @ 64°

1713

Wataru

2202' @ 64° @ 60°
2260

Need to return to station R and
finish the days traverse. Saw several
N-S oriented shears. They are as
much as a concern as the 290°-300°
set. Most of the rock is hard to very
hard and of good quality.

from station R
to station Q
traverse
1770
1722
1742
1713
8/20/82
KW

8-12-82

It's a beautiful, clear, sunny morning. Have to do a few things in the office before proceeding to the downstream portal area and finishing up yesterday's traverse.

Wabana

2260' @ 9° @ 60°

R = 1757' @ 10° @ 58°

82

R-S 82' 268° horiz.

W82-134 (R-U)

Rock (at 6'-15') is a greenish-gray, fine to medium grained diorite or quartz diorite. There may be enough quartz. Mafics comprise 20-25% and are generally fine grained. Rock is hard to very hard, competent, mostly fresh.

6.0' - 15.0' Somewhat active talus slope, 37°, fragments generally < 6". At the apex ~ 10' above the base line.

- most of the rock above is loose blocks up to 4' in diameter. Rock is hard, fresh. Does not appear to be a fracture or shear zone along the N-S or roughly E-W set. Above many large blocks are pulling away from the slope. JOINTS are along the N-S and 300° set. Why??

300° up to 10' long, 4'-5' wide

Long dimension of blocks are parallel to the 300° set.

6.0' - 15.0' Instability problems

Large zone of loose blocks, generally a minimum of 1/2" above the joints. Rock outcrop is up to 25' high.

45' - 60'

Large more massive part of the outcrop. Many of the joints are open but

there aren't as many loose blocks here.

@ 48' old rehealed fracture zone, 1' to 2' wide. Oriented 16° 85° W

Plane to slightly curved, smooth. Moderately weathered, moderately hard, incompetent zone. Not of discontinuous cross-cutting fractures within

@ 51' Possible shear(?) with breccia filling along part of this open joint. Open joint is up to 1" wide. Could have been a thin, highly fractured zone. 35° 85° W

@ ~55' outcrop face is slightly to moderately weathered.

JOINTS:

III' $0-30^{\circ}$ vert - 85° E; plane, smooth to slightly rough, 1" to 2' over. 6" to 1'. CO_2 coning. Some appear to be hydrothermally altered. One is soft & friable, altered diorite 1"-6". ~5% $\rightarrow$ 25% are open to 6".

IV 280° 45° S plane to sl. curved, smooth, 4" to 2.5'; over 1'.
 16 290° 60° N plane, smooth to sl. rough, 2" to 2'. Face of outcrop. Area spacing = 1'. Some hydrothermal alteration & CO_2 coning along joints. Moderately to severely altered diorite.

16a $294^{\circ}-300^{\circ}$ $45^{\circ}-53^{\circ}$ N-NE
 shear up to 6" wide. Most is brecciated rock. Fg sand to gravel - 10-20% silt & clay.
 - within is a 1" wide sand-clay moderately plastic, reddish brown, 20-25% fine to medium grained sand.
 - face is visible from 30'-40'

Above 60' gully which trends $\sim 200^{\circ}-310^{\circ}$.
 @ 73' to beyond 82'; greenish, mostly light gray, medium grained diorite. Quartz is 5-10%. mafics compose 15-25%. Generally the rock is

hard, slightly weathered, loose with many open joints up to 1". Very close to close fracturing in places in the outcrop. A lot of fracturing along the 320° set & are open. Unstable zone of rock

41
S-T 49' 222° 34° dn
DP-8

1726' @ 12°³ @
1721

S-U 82' 264° horiz.

0.0'-14.0 outcrop exposed ~15' at the baseline

14'-40' outcrop is exposed. 5'-7' higher up averages 20'

@ 27' Fracture zone, possibly some shearing associated with. Appears to be an old feature. Estimated 3.5' wide, heavy carbonate staining, possibly some hydrothermal alteration

352°-0° 85°W-vert
close to very closely spaced jointing, aver 4"-6"

Open joint ~1' wide, filled with boulders
112 284° 77°N plane, smooth to rough

JOINTS

* III 12° 85°E-vert, plane to ab. curved, smooth
face of } 2'-2', aver 1'
outcrop }
* 16 286° 85°S plane, smooth except weathered surfaces. 1'-4'
minut 300° 15°N plane, smooth; 4"-6' aver. 4'-5'

- rock is generally fresh to slightly weathered hard

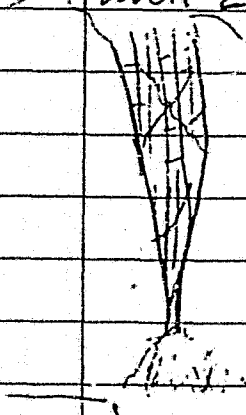
@ 14' Shear zone 2' wide
2" wide shear; breccia & gouge
Very closely spaced joints
2-0° 85°E
Silt/clayey sand, angular rock fragments to 1", yellowish orange

@ 40' outcrop face changes to roughly 290° orientation. A couple of pinnacles or detached blocks are just downslope from. Approx a 15' separation with pinnacles adjacent to base line

@ 47'-53' is an opening between the two d/s blocks which line up with a fracture in the 290° outcrop face.

$2^\circ-8^\circ$ $84^\circ E-81^\circ W$

Up to 2.5' wide. Very close to closely spaced jointing 1" to 6" over 2' to 3".



the gap between the two blocks and the main outcrop face is oriented $\sim 290^\circ$ and its trend may line up with a shear further down in the

downstream gully.

@ 65' on downslope side of blocks, several loose blocks

@ 12' within angle of slope

U to V 51' 240° 34° dn

- mapped this area previously

V to W 100' 267° 4° dn

- 6' downslope of SL82-H end point

W to X 71' 282° 0° dn

X to Y 61' 284° 10° dn

- crossed the main chute which we traversed up before, just above the highly oxidized zone but below the stop in bedrock. At the west end of the chute at bedrock.

99
Y to Z 100' 268° 7° UP
1756' @ 3' @ 74°
1740

W82-135 (Y-)

Green gray, fine to medium grained with some coarse euhedral feldspar, diorite
Mafics 20-30%. Trace of sulfides. ϵ^2
Very hard, fresh, competent, massive,
broken along several well defined joints.

Joints

III 20° 80°W plane, smooth 2' to 3'
II 280° 60°N plane, smooth; 6" to 2'
aver. 1' to 2'.

265° 60°N plane, smooth 1' to 2'
II minor(?) 60° vertical irregular, smooth
aver. 1'

- Outcrop starts at 55' on X-Y and
continues 12', ~ 10' high

@ 25'-40' rock starts again. Same rock
type. Rock is slightly weathered
 CO_2 & FeO staining

JOINTS:

II 10° 75°E plane, smooth
2" to 2' aver. 1'

II 290° 75°N plane to irregular, smooth
to slightly rough. FeO staining
Face of outcrop; 4" to 2', aver. 1'

IV 270° 20°S plane, & curved, smooth
1' to 3', discontinuous here.

@ 40' - 100' Active talus slope
some vegetation, but many fresh
boulders up to 18", some up to 3'

Z-AA 47' 276° long

W82-134 Outcrop from 0.0' - 15.0'. Approx
20' horizontal upslope 0'-3' above
is the base of a large outcrop sub-
parallel to the line. It is approx
15' high average and is 'long,
0.0' long. All talus along
slope beneath, physical weathering
is only slight as most boulders are
talus covered.

In the upper major outcrop the whole
outcrop is coarse, almost all joints are
open.

Possible shear oriented 230° in the small lower outcrop which would cut through the larger one where trees are currently growing. It is at 7' along the base line. Ave. 2' wide Photo. K82-3, 28

230° vert. irregular surface
Filling is typical of the breccia, silty sand - may have washed in through

@ 25'

JOINTS:

1b 315° 83° NE irregular, rough

III 12° 74° E plane, smooth
1' to 2'

IV 315° 23° SW plane, smooth
2' to 4'

II 65° 83° NW to vert.; plane
smooth

- all are open but the subhorizontal set, up to 3"

On Y-Z at roughly 84' and 15' up in elevation (est 30' horiz.) there is a shear zone at the ^{east} edge of the exposure we were just on. The joints trend:

292° - 295° 80° - 83° NNE

$\sim 320^\circ$ mostly near vertical

There is 1" of a green & white breccia gouge along a 295° joint. Jointing is primarily very close with some close the rock is hard and has a deep red earth stain - hematite. Minimum width of 4'. The adjacent slope above is covered with large loose blocks. Estimate maximum width of 10'. Shear is also the 295° trend.

The large rock cliff above looks very unstable

Outcrop continues for 73' on line

AA 1774' @ 44° @ 70°

1750

52

AA-BB 74' 189° 45° dn

- talus slope down to here. Beneath me is a uncovered talus slope i.e. vegetation mat cover has been completely removed. Am in the middle it is roughly 40' across

BB-CC 17' 78° horiz.

- all talus

CC-DD 35' 28 138° 36° dn

- all talus

- rock exposed ~ 8' across in the upstream direction

1672 1699' @ 535° K82-3, 288

- Highly fractured zone - inaccessible 78° 52° N oxidized, close to very closely spaced jointing. Est. minimum width 6'. Could be sheared

DD-EE 81' 161° 41° dn

- to 50' exposed talus
- @ 63' small outcrop ~ 5' on west side of line

45

EE-FF 70' 182° 50° dn

nearly continuously, rock along this stretch or very thin (skin thin) vegetation cover

FF-DP-2 28' 280° 30° dn
 DP-2 1576' @ 552° ~ 70°

E-1 1368

Joint

16 290 / 77N

planar, smooth, CO₂ stain
 base of outcrop ~ 6" to 3ft

minor
 355 / 76° W
 planar, smooth

III 020 / 80 E

planar, smooth
 sp 6 in to 1.5 ft, gen 1.5 ft
 CO₂ stain

IV 355 / 38 E

planar, sl. rough
 sp 1 in to 1.5 ft, or 6 in to 1 ft

TV 083/335

planar, smooth
 sp 6 in to 1 ft
 block sliding along this
 surface

2293' $\approx$ 6³⁵ (w 6¹⁵)
 2260

End of Book 19

Calculations checked
 by K.W. 2/22/82
 Geology plotted
 2/23/82 K.W.

CURVE TABLES

HOW TO USE CURVE TABLES

Table I. contains Tangents and External to a 1° curve. Tan. and Ext. to any other radius may be found nearly enough, by dividing the Tan. or Ext. opposite the given Central Angle by the given degree of curve.

To find Deg. of Curve, having the Central Angle and Tangent: Divide Tan. opposite the given Central Angle by the given Tangent.

To find Deg. of Curve, having the Central Angle and External: Divide Ext. opposite the given Central Angle by the given External.

To find Nat. Tan. and Nat. Ex. Sec. for any angle by Table I.: Tan. or Ext. of twice the given angle divided by the radius of a 1° curve will be the Nat. Tan. or Nat. Ex. Sec.

EXAMPLE

Wanted a Curve with an Ext. of about 12 ft. Angle of Intersection or I. P. = 23° 20' to the R. at Station 542+72.

Ext. in Tab. I opposite 23° 20' = 120.87
 $120.87 \div 12 = 10.07$. Say a 10° Curve.

Tan. in Tab. I opp. 23° 20' = 1183.1
 $1183.1 \div 10 = 118.31$.

Correction for A. 23° 20' for a 10° Cur. = 0.16
 $118.31 + 0.16 = 118.47$ = corrected Tangent.

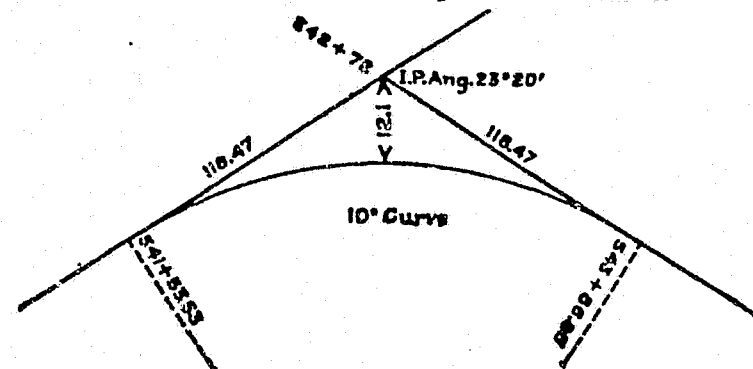
(If corrected Ext. is required find in same way)
 Ang. 23° 20' = 23.33° $\div 10 = 2.3333$ = L. C.

2° 19½' = def. for sta.	542	I. P. = sta.	542+72
4° 49½' = " " "	+50	Tan. =	118.47
7° 19½' = " " "	543	B. C. = sta.	541+53.53
9° 49½' = " " "	+50	L. C. =	2.33.33
11° 40' = " " "	543+	E. C. = Sta.	543+86.86
	86.86		

$100 - 53.53 = 46.47 \times 3' (\text{def. for 1 ft. of } 10^\circ \text{ Cur.}) = 139.41' =$
 2° 19½' = def. for sta. 542.

Def. for 50 ft. = 2° 30' for a 10° Curve.

Def. for 36.86 ft. = 1° 50½' for a 10° Curve.



AAL BOOK 20

CONTENTS

LAYOUT:

SEISMIC LINES:

109; 111-117

GEOLOGIC MAPPING:

DOWNSTREAM PORTAL

1-20; 145-151

UPSTREAM PORTAL

21-108; 127-145

STA. NUMBERS

WS2-138 through 175

Book #20

(1)

8-13-82

It's a clear, sunny day. Will continue mapping in the downstream portal area with a river traverse & work in the area of the portals.

Watana 2260' @ 64' @ 53°

DP-1 = A

1451' + 451' @ 73° @ 51°

- outcrop 12' high & 35' across, see
- 1' winter mapping

A-B 100' 99° long 100'

66'-93' outcrop ~ 25' over
& 12' higher in elevation. Is
approx. 6-8' high subparallel
to river. See winter mapping

B-C 51' 37° 30° up 44'

W82-138 (c)

Surveyed to center of the outcrop
It is 8'-10' high and 25' long

across slope 1503

Elev. base: 1493' @ 75° @ 53°

Rock is light gray, fine to medium grained diorite. Possible trace of quartz. Mafic ~ 20%. Fresh to slightly weathered, hard, competent blocky to massive. Small veins 1/2" thick, fine to medium grained more sodic rich material, dioritic crosscut the outcrop. Sharp contacts.

310° 25° NE

78° 48° N

JOINTS:

* 325° 87° W plane, smooth

1/4" - 2', aver 6" - 1'

- one has a zone 1/4" of fractured possibly sheared material.

5' from E end. Discontinuous vert.

60° 35° SE plane, smooth

4" to 3', aver 2'

* 48° 80° E plane to curve, smooth

2" to 1', aver 6" to 1'

minor 8° vert sl. curved, smooth

6" to >3' aver 2' to 3'

* 280°-288° 79° S L. curved, smooth

form
face of
outcrop

part of

* 280° 45° N plane, smooth

6" to 3', at 2'-3'

Green plagioclase, medium to coarse grained, composite 10-20%

C-D 100' 97° horiz 160

from 75' on, some exposed talus blocks most ~~are~~ covered by thick vegetation.

- rock cliff just above which we worked on earlier

D-E 65' 103° horiz 65

@ 23' E further, bedrock outcrop

W82-139 (E)

23' - 61' bedrock w/ good exposure from 51' to 61' approx 6'-8' high

forms a slight ridge going up slope

Light gray, fine to medium grained diorite

Mafic composite: 25%. Trace quartz (?)

up to 10%, may only be 5%. Fresh to slightly weathered, hard, blocky, loose.

Trace (<5%) green plagioclase.

Most joints are part open to open especially the N-S set 1/2" to 1" max.

Loose outcrop

JOINTS:

6° 82° E plane, smooth
1" to 1.5' aver; 6"-1'

027/27° E gen, but up to 42°
plane, smooth
sp 4 in to 1 ft.

283/75 N
plane, smooth
sp 6 in to 1.5 ft, av. 1 ft

084/50 S
plane, smooth
sp 1 ft

058/70 NW
plane, smooth
sp 1 to 1.5 ft

E-F 48' 120° 21° dn

0.0' - 41.0' nearly continuous
rock exposure somewhere in the

height of outcrop from pt F to ~17'
above. Small chute between outcrops.
Outcrop is another ridge going up slope.
Rock is the light gray, fine to medium
grained quartz, diorite. mafic comprising
25-30%, biotite & hornblende. Trace
quartz, uncertain % percentage. Mostly fresh rock
Small fracture zone at 20' 19'
oriented 355° 56° E plane, smooth.
Very closely spaced jointing 1/2" to 3".
Is approx. 6" to 1' wide. Some
carbonate staining. Also is a strong
joint set here

JOINTS:

71° 84° SE plane, smooth; 1" to 5'
aver. 6" to 12"

328° 84° SW plane, smooth to sl.
rough; 1' to 3'; face of
outcrop

3° 27° E, small fracture zone
plane - irregular, smooth,
discontinuous; 6" to 2' aver. 1'
- zone is 1' wide; 1" to 6"
aver. 4"

60° 50° NW plane, smooth

discontinuous; 1' - 6'

- talus is beneath to river 76

F to G 78' 85° 12° UP

- most trees & vegetation, presume
much of slope is covered talus

G to H 63' 72° 24° UP 58

H = DP 3

152' 154' 5' @ 95° @ 58°

@ 29' outcrop with thin vegetation
cover, not well exposed. Closely
spaced jointing, FeO staining

Outcrop is 30' long at a 280° trend
Slightly to moderately weathered

Fracture zone 15' wide; tight joints

70° 85° E plane - sl. curved, smooth
1" - 6"

- one zone at 15' where it is 10"
wide, loose, 1/4" to 2"

Downstream side of zone is some
possible breccia zone 1/4" wide,
possible shear.

Joint - face of outcrop.

285° 65° S plane, rough

appears to
line up
w/ one
above

1' - 2' of outcrop, but the last two feet
the jointing is close to moderate close.

Only slightly weathered.

- the last two feet jointing is close
along the N-S set.

H to I 100' 137° 18° IN 95

@ 21' - 32' small outcrop exposed
only a 3' high exposure

@ 81' - 87' small loose exposure.
bedrock is near the surface; approx 10'
much of which is covered by vegetation.
Loose blocky material

@ 87' - 100' talus slope

I to J 91' 98° 21° IN 91

- all talus across the slope with
boulders up to 3'. Vegetation
covers most of it

J to K 19' 71° 23° UP 17

W82-140 (K.)

Small outcrop ~ 20' across & 6' high. Greenish-light gray fine to medium grained diorite. Mafics are fine grained Green plagioclase comprises ~ 10%. Hard fresh to slightly weathered, bluish, competent. Some are loose blocks. Small discontinuous felsic pods.

JOINTS:

7° 67° E plane, smooth; ½"-3" over 2" Fracture zone minimum width of 1.5'.

287° 60° S plane, smooth; 6"-2"

minor 230° 55° SW plane, smooth to sl. rough. 2" to 1.5'. Discontinuous

K-L 73' 118° 7° dip 72

- vegetation covering the talus slope. Blocks up to 3'.

L-M 100' 93° horiz.

- vegetation covered talus slope, ~ 30°

M to N 98' 106° horiz 98

M is approx coffee dam location. A.11

talus here covered by vegetation, slope steepens up slope slightly.

M to O 92' 3° 35° dip 75

DP-4 = 0

3 1585' @ 114° @ 71°

Will walk from M down to river, slope flattens out a few feet down, alluvium / talus.

Coffee dam Location W82-141

At river, alluvium, generally sub-rounded and rounded, just a function of sphericity, some subangular. Range up to 2', good gradation from 3" up to 2'. Slope is 4°-7°. Matrix is primarily a fine grained sand (on surface). If one were to dig a pit silt would probably be observed.

Good exposure due to low river level.

Composition is mainly granitic with volcanics & melaschistony

Photos K82-3; 29-31

Will start a traverse from DP-4 to
tail and tunnel portal. 2nd traverse today.

DP-4 1590' @ 195° @ 73°

"A" 1553

A-B 94' 322° 16° UP 90

- entirely in talus material which
has been covered by vegetation
@ 53' boulder 8'-9' in diameter

B-C 100' 287° horiz. 100

- talus slope from above ends @
59'. Then bedrock outcrops,
a station we visited earlier
and extends beyond this segment.
There is also talus beneath this
cliff.

C-D 79' 273° 3° UP 74

- outcrop ends at ~26'
- back into thick talus slope
boulders up to 4', very irregular
slope indicative of thin
vegetative cover. Some boulders
have only slight moss cover.

D-E 100' 287° 10° UP 98

@ 65' to just beyond this segment,
talus boulders are primarily covered
by lichen with very little moss
cover ~10-15% and no soil
development. Nevertheless it is inactive

E-F 75' 326° 27° UP 67

@ 60' the inactive mostly non-
vegetated cover ends. Still in
talus material but the slope is ~70%
vegetation covers some thin soil
development above. Lines up with
active feeder where spalling occurs
from a bedrock cliff exposure

F-G 97' 287° 9° UP 96

- passed DP-8 just above the line
Still in a talus slope cover; 80-
90% vegetation cover.
1702' @ 2°

G-H 41' 215° 38° down 32

@ 26'-38' passed the east
edge of an outcrop

W82-142 (H)

Outcrop 18'-20' across E. 6'-10'
across a light gray, fine to medium
grained quartz diorite. Quartz ~10%
Mafics ~25%; biotite & hornblende(?)
Hard to very hard, competent, fresh to
slightly weathered. CO_2 & FeO staining

JOINTS:

355° 78° E plane, smooth

8" to 1.5' over 1'-1.5'

290° 67° N plane, smooth

face of outcrop; 1' to 1.5'

298° 36° S-SW plane to sl. irregular,

sl. rough 1.5' to 2'

minors 66° vert. plane, smooth, 3'H to I 61' 276° 6° UP ⁶¹

- talus slope between, vegetation
mat may be thin w/ bedrock near
surface from 4 to I

W82-143 (I)

Outcrop is 10' upslope. It is 4' high
and ~12' long. May be continuous since
station 4 with thin vegetation cover. Light gray
fine to medium grained quartz diorite. Green
plagioclase less than 5%. Fresh to slightly
weathered, hard. Some joints are open, outcrop
is somewhat loose.

JOINTS:5° 85° E plane, smooth; 3" to 1'
aver. 0.5' to 1'300° 72° N plane, smooth to rough
face of outcrop (1); ~1.5"??50° 85° SE vert. plane, smooth
2" to 1"; aver. 6" to 1'315° 45° S plane, smooth to sl. rough
2' to 1.5'; aver. 1' to 1.5'I to J 91' 286° 12° UP ⁸⁹

- crossed a talus slope which is ~30%
covered by vegetation mat or moss
- at bedrock

W82-144 (J)

Outcrop is 11' across & 6' high
 Greenish - light gray fine to medium
 grained diorite. Mafic 20-30%
 some are chloritized. Green plagioclase
 phenocrysts, 10-15%. Estimate trace
 of quartz $\approx 5\%$ Hbl is chloritized (?)
 Rock is fresh, hard to very hard,
 blocky. Some granitic dikes/veins
 1" wide. Coarse grained. Majority
 of joints are open, up to 1"

JOINTS:

298° 70° S plane, smooth
 > 3'

355° 75° N plane, smooth
 1' to 1.5'

315° 75° E plane, smooth
 1' to 2'

90° 35° 45° S plane to curves
 smooth 1' - 1.5'

minor 305° 32° N plane, smooth
 discontinuous; 6" locally
 > 2'

Nothing but talus above this point
 & to the NE until you cross the SL82-H
 where there is a cliff face that was mapped
 yesterday.

J to K

50'

201°

48° down

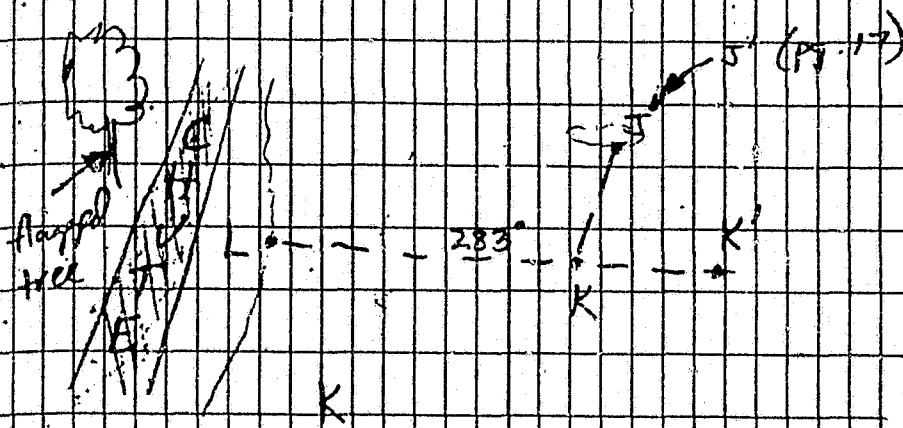
1034

1709'

@ 347

@ 73°

set up a base line for outcrop
 we went down over.



K-K' = 30'

K'-L = 100' @ 283° 2° UP

100

W82-145 (K to L)

- ⑧ 0.0' - 22.0' outcrop averages 5' high
 Rock is the green-gray, fine to medium grained diorite. Matrix: 25-35%, partly chloritized. Green plagioclase comprises 20%-30%. Very hard, blocky, competent, fresh. Light staining of FeO, CO₂.

JOINTS:

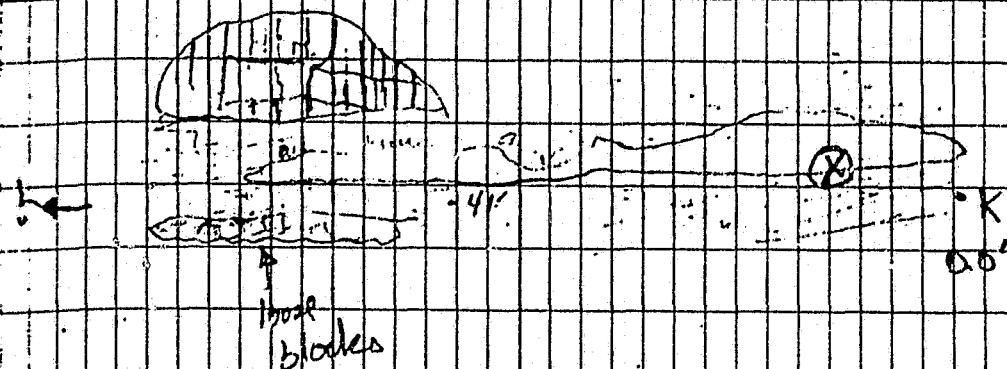
- 295° 72° N plane, smooth;
 trend of outcrop; ~1'
 10° 85° W vert.; plane to sl.
 irregular, smooth; 1" to 1', aver. 6"
 68° 76° NW plane, smooth
 2" to 3"; 1.5' to 3' aver.

minors

- 201° 8° W plane, smooth
 discontinuous; 1'
 310° 30° NE plane, smooth; 2'.

22.0' - 49.0' outcrop is ~3' high
 41.0' - 60.0' approx 3' above bottom
 exposure, rock is exposed above

up to 8' high. Small bench exposure
 below, exposure is 3' high
 - along these two stretches N-S set
 has a 6" to 2' spacing, aver. 1'



X-SECT.

@ 60' & up slope 5' elev.

- 5° 84°-87° W plane - sl. irregular
 smooth 3" to 2.5'
 75° 35° S plane, smooth
 1' to 3'

J' Loose blocks exposure on an east facing slope, the rock has slumped some. Possible shear that has slumped (?) with these blocks. Approx 2" wide

295 50° N

rusty orange silty sand oriented
295° 50°N

All joints are open, therefore orientation
may be off. Possible line-up with
the one in the gully/chute.

L to M .71' - 292° 71

M = X on 8-4-82, flagged
birch tree. Just crossed the
chute

ELEV. ~~1734'~~ @ 5° @ ~70°
1641

N82-146

Going down the chute looking for
shears. West of chute, east side of
next chute over. Yesterday came down
slope on the west side of this chute

EL. ~~1720ft~~ 525PM
1670

Discrete, greenish gray, fine to
medium grained, most joints
open to 1 inch; loose, unlithified

Joints (all disrupted, due to slumping)

075/50S

planar, smooth
sp 2ft and greater

273/70N

planar, smooth
sp 1 to 5ft

055/77SE

planar, smooth
sp 1 to 2.5ft

020/80E

sl. rough, planar
sp

~305/62 SW

planar to sl. and
sp 3in to 3ft, or 1 to 2ft

W82-147

Going down the ridge between the two chutes. Probable fracture zone maybe sheared. Could be up to 10' wide. Looks to have the E-W set 25-40N(?) into the hill. Loose rock ^{could have slumped}

ELEV. 1581
1584' @ 5°E

Lines up with the first bedrock step above the river in the chute - we traversed. Face of step

295° 75° S ←

DP-1

1564' @ 5°E @
1457

Watana

2345' @ 6°E @ ~70°

Traverse
Plotted
Geology
8/20/81
KWW
8/29/81
KWW

8-14-82

It's a mostly cloudy day. High clouds moving in. It is pretty clear to the south of us. Will start mapping in the upstream portal area today.

Watana

2260' @ 6°E @ ~54°

UP-3

1556' @ 7°E @ 59°

AF

A-B

58'

303'

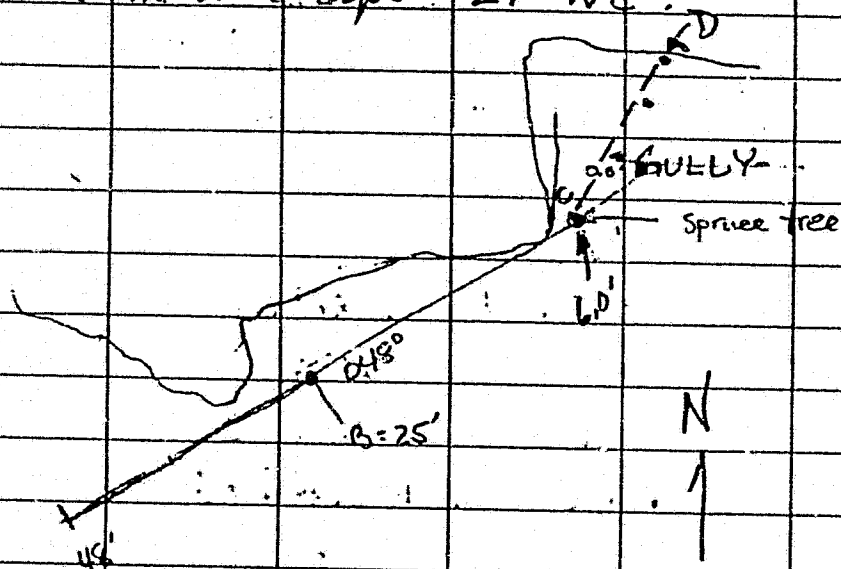
27° UP

@ 48' small area of active area of talus material up to 3', area ~ 6'

W82-148 (B, C, D)

Downstream end of Fins bedrock cliff exposure. On the south-facing side of cliff. Exposure is up to high. 1601' @ 7°E

SET UP a baseline 48° azimuth
and the line dips 24° NE.



PLAN VIEW

Diorite, greenish gray, ^{generally} medium grained,
with some fine grained mafic
possibly 5% quartz, 20 to 30%
mafic (biotite and hornblende?),
trace potassium feldspar, 20 to 30%
green plagioclase, remainder is
white feldspar, fresh, very hard
to hand. Irregular areas of healed diorite breccia.
Outcrop is generally blocky with
local areas of very close jointing,
most joints close spaced.

I into

335 / 85 NE to 87 W

planar, smooth
trace carbonate coating
Sp. 1 in to 2.5 ft, or 1 to 2 ft

IV

042 / 47 SE minor local set

^{to curved}
planar, smooth to rough
discontinuous, sp 2 in to 6 in

VI

072 / 60 SE

planar to curved
smooth to rough
sp 6 in to greater than 1 ft

056 / 58 NW

sp 2 in to 3 ft, or 1 ft

075/48NW

planar to sl. curved
smooth to sl. rough
sp 2 in to 2 ft, as 7 ft

Fracture zone at 28 ft

highly oxidized (FeOx) sl to
med with 3 ft exposed, loose
subparallel to face of outcrop
joints

045/62SE trend of zone
planar, smooth,
sp 1 to 4 in,
some discontinuous

077/67 NW

planar, smooth
sp 0.5 to 5 in

0.0' is at edge of gully which trends
approx E-W - main face at top of
gully is 335° set.

C-D

31°

21°

rising

51°

- segment across the apex of the gully.

GULLY AREA

@ 30' above, below 5', same

(S) opening - open joint. Silty sand
filling up to 1' wide

330° west.

- east side of gully width is 6"
highly fractured parallel to gully
spacing 1/8"; edge of trend of joint
joints are tight. No appearance of
being cataclastic (shear welded)
Old SHEAR(?) - Rock is slightly
weathered & has a dull round when
struck

- above at large opening SW side
of opening rock is of poor quality
moderately to highly altered along
the joint face some

(g) slightly to moderately weathered, highly
fractured, fractures are discontinuous
locally above 25° 10° SE plane

Granitic dikes, 1" wide, Qtz. 20-30%; 340° 58° E
Fine to medium grained. Fresh. Less fractured than
surrounding rock.

52-1480

JOINTS: 25' - 30'

II 58° 77° SE plane, smooth to slightly rough. 6" to 1', face of gully at (8), - some slumping towards the gully.

I 270° 72° N plane - sl. irregular, smooth 1" to 6" aver. 4"

II 320°-330° 85° E - vert. plane - sl. curved, smooth; 1" - 1'; where fractured. 1" to 2"; unfractured ~ 1'.

minor. 25° 10°-30° SE plane - sl. curved, smooth 1" to 1'; aver. 6" to 1' - may be discontinuous

(+) possible discontinuity on west side heavy FeO staining, moderately weathered & somewhat friable, 1" thick. Trend would be 330° 85° NE - west.

Max. width would be 1.5' - felsic dike on NE side, 1 1/2" wide is not seen on SW side. Trending ~ 270° 65° N

Tagged STA C

Photo K82-B, 33

B to E 37' 234° 23° UP 34
- talus with relatively thick vegetation cover ??

E to F 75' 321° 34° UP 62
- bedrock outcrop. Top of last outcrop is at this height
- 1657' @ 103° @ 60°
- set up a base line (F-G)

F to G 82' 53° 36' 82
to ridge its 36'

W82-149 (F-G)

Off and on outcrop exposure. Outcrop from - 710' to 13' on base line averages 5 to 10' high

Quartz Diorite, light gray to light greenish gray, fine to medium grained, approx. 5 to 15% quartz, 20 to 30% mafic, less than 15%

of green plagioclase, fresh to slightly weathered, gen. fresh, some perthite Fe staining, hard. Outcrop fractured along close spaced joints.

Feldspar dike, about 1 in wide, medium grained offset along 321-336/46-60 SE Jt. predominantly feldspar, less than 10% quartz. Hard, unfractured, tight contact. 325/72 NE subparallel to offsetting joints.

Joints

III 321-336/46-60 NE
planar to sub-planar, curved, smooth
sp 1 in to 1 ft, or 6 to 8 in

I 271/385 to 70 Facemaker
sl irregular, rough
sp 1 in to 1 ft, or 3 to 6 in

IV 293/485
planar, sl rough
sp 6 in to 3 ft

II 051/64 NW
planar, smooth
sp 4 in to 2 ft, or 1 ft

@ 30'-37' rock ridge that goes out to the top of outcrop 82-148. Most of the side slopes of this ridge have a moss covering.

@ 39'- gully extension above 82-148. At this elevation rock exposure to 15'-25' higher.

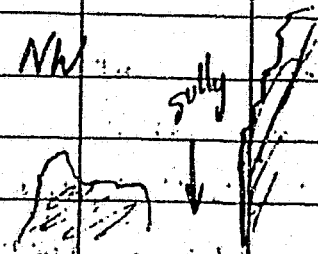
@ 70', 3' wide gully with no bedrock exposed in trends up slope with 15' high rock faces on either side. The gully is at least a highly fractured zone, possibly sheared also. Trends:

320° 74° SW to west
plane, smooth. Spacing is 1" to 6"

Also very closely fractured along 15° 46° E plane, smooth. Clz coating 1/2" to 6"

- Lines up with a gully on the other side of the river at 325° and at 325° to the edge of a bedrock cliff - large

to the NW



Open irregular crack up to 8" filled with cobbles trends to the S-SW

There is a great deal of loose blocks & large block cliffs separated by large open joints - Joints seen to be parallel the river

Along the gully the rock is slightly to moderately weathered. Very closely spaced jointing. Rock has been partially healed but still breaks in 1"-2" pieces generally. Rock is dried up by the NW, NE & 15° set

F to H 17' 234° 15° UP 16

H to I 70' 23° 23° UP 64

I = UP-2

1702' @ 12 15 @ 63°

W 82-150

I to J

44'

319°

11° du

4/3

- top of a "V" shaped gully
- on the upslope side from 24'-44' rock outcrop, FeO staining. Close to very closely spaced jointing. Outcrop is 3' to 5' high.

- from UP-2 to 28' on the line on the downslope side is a 15'-25' high rock pinnacle. Along this traverse between the pinnacle and the slope is a shear zone(?).

Trend could be set on 340°-345°

Good bed it is 330° to miss and 1K exposures

- Moderately to highly altered, weathered outcrop face is friable. Have a yellow-orange sandy silt trace clay adjacent to. Trend of rock face 342° west. Ca & FeO staining.

- going down the gully, can see a highly fractured & oxidized zone exposed where the shear from 82-149

crosscuts. There is also another

Open Joint? } potential one between these two which would be ± 2.5' wide & is between the aforementioned pinnacle and another one

Trend 316° west. Gap between
is filled with angular cobbles & boulders.
Competent rock on either side not like
the other two. - Probably an open joint
block is pulling away

Joints taken on gully side of
pinnales in competent rock

JOINTS:

III 332° 85° SW plane, smooth
3" to 2' aver. 1'

IV 47° 50° NW plane, smooth
1" to 1.5' aver. 1'

I 292° west plane, smooth
4" to 2' aver. 1' to 1.5'

N 80° 43° S plane, smooth
1" to 2' aver. 1'

II 66° 80° SE plane, sl. rough
6" to 2' aver 1' to 2'

16c Small shears - two parallel, 3.5' apart
 73° 11° S old shear 4" to 6"
wide, old, clay, loosely
fractured, etc.

Watana $2261'$ @ 23° @ 55°

Adjacent to UP-2 looking north, could
see several large open joints. A series of
these could follow the trend of the river(?).
Anyway as a result there are many large
blocks and pinnales which could be loosened
during diversion tunnel portal work.

Shears/Fractures mapped today could line
up with gullies on the south side. Feel
we have good match-up.

Stopped early due to rain!

Fracture plotted
8/29/82 NW
Goody plotted 8/30/82

8-15-82

Partly sunny mornings, breaking
up after last night's downpour.
Will work in the upstream portal
area.

Watawa

2260' 6⁵⁵ @ 52°UP-3 1540' @ 7⁴⁹ @ 55°UP-2 1665' @ 7³³ @ 55°

UP-2 = A

A-B. 36' 200° 29° di 31

B-C 17' 280° 32° UP 14

C'-D 55' 242° horiz. 55

- C is at 6.0' on base line

- C' = 0.0' at NE end

W82-151 (C'-D)

1670 @ 7⁵⁰ @ 55°

Diorite, light greenish gray,
fine to medium grained, mostly
medium (fine grained mafic),
no visible quartz, 15 to 25%
mafic (mostly biotite, kln in
altered with rusty staining), less than
10% green plagioclase (plagioclase
(medium, possibly coarse grained))
generally fresh to slightly weathered
some penetrative FeO staining,
CO₂ staining on many joint
surfaces, hard.

Outcrop face is vertical, with
generally close spaced joints

6.0' to 27.0'

Shear - very closely spaced fracturing, heavy carbonate staining oriented; overall E-W with $\approx$ the dip to 90° 25° S south, strike & dip vary across outcrop; irregular wavy surface. Width is $\frac{1}{2}$ " to 5". Locally may pinch out. Approx 25% of joints crosscut it, the others terminate at. Only set that continually crosscuts is 325° 85° W plane, smooth. Old shear same as seen yesterday. No gouge, fractures are tight, fractures $\frac{1}{2}$ " to 1" - curved, smooth.

OLD SHEAR @ 11.0'

Varies from $\frac{1}{2}$ " - 3" wide, very closely spaced jointing, some breccia. Joints $\frac{1}{4}$ " to 1". Some silty sand breccia, discontinuous. CO_2 staining. Some is friable. Is truncated by the subhorizontal shear.

JOINTS: 6.0' - 14.0'

- ~~IV~~ 295° - 305° 40° - 50° E plane to curved, smooth, 1" to 1.5'; aver. $\frac{1}{2}$ " to 1". Some are discontinuous.
- II 40° - 55° vert. - 85° ^{NW} plane smooth. One face of outcrop; 6" to 3'; 2' - 3' aver.
- I 290° 85° S plane to curved, smooth to rough face of outcrop; 2" to 4'; aver. 2' - 3'. Most are discontinuous.
- ~~III~~ 300° 60° S plane, smooth. Generally discontinuous except from 0.0' - 4.0'. Spacing $\frac{1}{2}$ " to 1". Dies out to west. At 4.0' - 12' generally 3' & greater - some joints are open.

JOINTS: 14.0' -

- III 325° 85° SW plane, smooth 2" to 1.5'; aver. 1.0'
- III 320° 60° NE plane, smooth 1" to 3'; local zones of 6" generally 3'.
- IV 45° 25° - 50° SE plane, sh. rough 4" to 2'; aver. 1'. Discontinuous.

II 55° 85° NW plane to sl. curved, rough,
6" to 2'; av. 1'

Sketched

D to E 55' 188° 10° ⁵⁴ du

bedrock ridge going up slope from
23.0' ^{just} beyond 55'. Outcrop is
roughly 8" high & continues off
on, exposed upslope on ridge.

Across slope it is probably ~25%
moss covered

Crossed a gully that could have
a possible shear & fracture zone
305°

Gully side of outcrop 330°, the
other outcrop face is ~20°

Some of the joints are open to 2"
on this outcrop

Joint

312 to 325 / 87° W to 75° W

sl. curved, rough

sp. 3 in to 1.5 ft, av. 6 in

II 043 / 83° NW to 73° NW
plane to sl. curved

sp. 3 in to 1.5 ft, av. 6 in to 1 ft
open to 3 in on east edge of outcrop

~~II~~ 062 / 67° SE

planar, rough
sp. 6 in to 3 ft, av. 2 ft

IV 358 / 18° W

slightly curved, rough to rough
sp. 6 in to 3 ft, av. 2-3 ft

E to F 37' 232° 41° ²⁸ du

- on the SW facing slope side of
the ridge in another gully. Rock
ridge with and here.

16.8' @ 94° @ 50°

Set up a base line G-H

G-H 99.0 305° 35° ⁸¹
W82-152

SD

@ 61.5' is STA F 81

G = 0.0' is upslope, H = 99.0' is downslope
of STA F.

W82-152 (G-H)

@ 40' ³³ ⁴⁹ 60.0'

Felsic dike, fine grained, light orange.

at contact, gray, 20-30% quartz, no visible mafics,
rest is feldspar. Bordered by two shearsCenter of dike, < 10% quartz, light orange gray
width = 1.5'. Hard, highly fractured, veryclosely spaced, tight. Thru going joints
especially the top shear; not same on the bottom
shear JOINTS 50° 72° SETop subhorizontal shear. Width 2"-6" of
breccia. Moderately hard, highly fractured,
moderately weathered 175° 35° WLower subhorizontal shear. Width of
1" to 2", same as aboveBoth shears are healed, not completely
competent, weak plane

Dike is very closely fractured

45° 75° W maybe 70°-85° W

looks possible

Rock beneath & above the dike has been
sheared at one time, mostly fractures which
are discontinuous rather than thru going
jointsApprox. vertical, 1" dikes beneath
large dike, same material. Dikes have
been sheared. Minor effects, may have
occurred when rock was still somewhat in the
liquid stage. Effects ≤ 2". Dikes (?) orientation:
40° 85° SEPieces of small dikes scattered throughout rock
outcropRock body is a healed diorite breccia
Hard, highly fractured which are healed,
most fractures are discontinuousNear vertical shear separates the healed
diorite from the good diorite. Goes up to the
large dike & truncates (?) it - unsure can't
get up to it. Orientation

330° 80° SW

Similar to subhorizontal ones except
increased weathering. Width 6" to 1"PHOTO K82-3; 34, looking at NE trending
dike, healed breccia.#35 shear
#36 outcrop

64 69
@ 78'-84' (sketch is off)

Open joint possible old shear, highly fractured @ downslope end of outcrop, segments of like material - felsic.

61 85
@ 91'-104' 60° 45' SE 1/2" to 6" ?

Shattered appearance of the healed breccia. Once exposed to the elements, the rock disintegrates into gravel to cobble size pieces due to weathering along healed fractures. Rock also is friable on exposed faces, weathers along grain boundaries.

26 79
@ 30'-35'

Diorite breccia, healed. Slight to moderate weathering, moderate on the outer surface. Moderate hard to hard with local pockets of friable material, mostly along joints. CaCO_3 coating on most surfaces. Joints all very closely spaced face of outcrop.

315° 85° SW

8 16
@ 10,0'-20.0

Greenish - light gray to light gray, fine to medium grained diorite. Matrix 20-30% Quartz + 5% Green plagioclase stals, medium to some coarse grained, 5-10%, stained or altered, breaking down to clay. Hard, slightly weathered. Broken along close to very closely spaced jointing. Most are partly open, rock is loose. Some diorite breccia.

Joints:

1295° 55° N plane to curved, smooth to sl. rough, 1" to 1', aver. 6".

- appear to be discontinuous

162° 45° SE up to 60°; plane smooth; 1/2' to 2'

- above as noted in sketch aver. = 4'

- bottom aver. 2'

minor:

III 323° 80° SW plane, smooth; $\geq 2'$ discontinuous

IV 45° 70°-80° NW plane to sl.

curved, smooth, discontinuous 1/2" to 6", 3' spacing between 1/2" to 6" zones, zones are 1' wide

② 0.0' - 10.0' 45° set is major, 1" to 1' aver. 6". Also continues for another 20' upslope.

③ - @ 15' upslope from base. Dipping out of hill
JOINT

55° 75° SE plane to surface, approx.
1/2" to 1' aver. 6"

- gully is takes material covered by vegetation, alders, occasional birch
- sketched

F to I 96' 280° 23° UP ³⁸
- crossing the gully Pt I is in line ~ with bedrock edge (on the EW side of gully), above this point the bedrock wall is at 19.0' on line segment I to J

I to J 19.0' 212° 23° UP ¹⁷
Pt J is on a small narrow bench (joint) which crosses over the ridge. Excellent exposure of rock face from here up for a minimum of 100'

Ran a baseline up for
- J = 0.0'

66
- J' is 72.0' oriented 310° @ 23° UP.

- gap in rock exposure, note just below J for ~ 25'.

W82-153 (J-J' is beyond)

Face of outcrop follows the 308° 79° NE joint set. Greenish-grey, fine to primarily medium grained diorite. Matrix is 20-30" primarily, biotite. Rock is hard fresh to slightly weathered. Rock face is weathered, sounds like there are some part open to open joints parallel to the cliff face 18 2'.

@ 20'-28' fracture zone. Close to closely spaced joints. Rock is 46°-50° 75°-82° SE

FeO stained. Width 8'. Rock is broken up. Spacing is 1" to 4"

④ Matches up with the other side of gully 66

@ 45.0' - beyond 72.0'

Rock is slightly to moderately weathered and highly fractured. Rock is of poorer quality than that which is at 10'-150'. Diorite is

more sodic here with less distinct biotite

OLD Shear zone, highly fractured & jointed.
Spacing is $\frac{1}{2}$ " to 3", up to 2' wide.

Orientation:

22° 55° W

Heavy CO₂ staining

Very close to

A closely spaced joints, at 310° 80° NE
adjacent & parallel to gully which may be
indicative of fracture zone in gully. Zone is
3' width. Generally on this set it is
1' to 2'.

Rock is moderate hard, has the
shattered appearance. Believe breccia
low in outcrop @ 45' - 75'.

JOINTS:

41 41

II 40°

next to 85° SE plane, smooth
locally discontinuous; 2" to 4"
aver. 1' to 2'

I or III 310°

80° NE, plane, smooth
2" to 8"

IV 22°

55° W, plane, smooth
1" to 1'

in breccia

II

330°

32° SW

irregular, smooth
to rough, discontinuous; 8" to 4'

J to K

62'

223°

horiz.

K = UP-1

1663' @ 1/5" @ 60°

-UP-1 is right above bedrock cliff

Small Bedrock exposure just upslope
of UP-1 along the traverse, averages 10' high
Goes from J to 25' upslope of K
Greenish gray, fine lamellum grained diorite
with distinct biotite xstals

JOINTS:

I 300°

78° NE plane to sl. curved,
smooth. 8" to 2.5'; aver. 2'

II 35°

80° SE plane, smooth; face
of outcrop; 1" in fracture zone
to 1' generally 6" to 1'

-fracture zone is minimum 3'. Lies
up with fracture at 20' - 28' on
segment J to J' (?).

IV 284°

6° N plane to sl. curved,
smooth, in fracture zone 1" - 6"
otherwise 2' - 3'

K to L

46'

66°

31° dn

L to M 93' 198° 26° dn

- rock is exposed from 15.0' on

1082-154 (L to beyond M)

OUTCROP exposure which slopes downward across slope to beyond M. Averaging height is ~15'.

@ 30' UP-1 is approx 15' above.

Rock is a greenish-gray, fine to primarily medium grained diorite. Mafics comprise ~25% chiefly biotite. Moderate hard, slightly weathered, has shattered appearance - close to very closely spaced fractures, mostly iron stained, difficult to get an unstained. Most of the fractures are holed but the rock always breaks along the fractures. Most fractures appear to be discontinuous. Two through going joints.

JOINTS/FRACTURES: @ 34'-52'

I or III 315° 80° NE plane, smooth; 2" to 3'; even 1' to 2'

II 40° 88° NW plane - d. smooth face of outcrop. 2" to 1'; 6"

IV 337° 24° SW plane, smooth 6" to 4'; even 2' @ 34'-38'

Intersection of three joint sets discontinuous fracture zone. Doesn't go into the wall, was too poor. See if it isn't the intersection of joint 50° west

sets:

@ 57' Open joint slumping of rock fragments within, loose blocks.

@ 70'-75' 40° set has even spacing of 2' to 4'

@ 79' Light gray felsic dike. Aphanitic with 5-10% feldspar phenocrysts that are fine grained. Hard, very closely fractured, ~16" wide trending 57° 87° SE.

NE contact is sharp, tight and the SW as well. May be crossed out by a fracture zone

⁷¹
 @ 79'-87' Fracture zone which trends:
 35°-52° 82° SE - vert.

Spacing is 1/2" to 3", plane to sl. curved.
 smooth. zone is 4.5'-5' wide. On the
 SW side of the zone fractures are mostly
 slightly curved & a 45°-52° strike. Very
 close to closely spaced fractures.

⁴⁶
 82. Other joints/fractures in the fracture zone:
 I - 52° 50° NW curved, sl. rough
 to smooth 1" to 1'. thin going joint.

II - 50° 82° SE plane, smooth
 1" to 4" aver. 2", fracture

IV 335° 148° SW plane to irregular,
 smooth, discontinuous;
 aver. 4"

I ~~III~~ 310° 80° NE plane; smooth
 discontinuous; aver. 1"

IV 310° 33° NE plane, smooth
 discontinuous; 2"-3"

⁸⁴ ⁹⁴
 @ 93'-105' Fracture zone
 25°

The two zones combined give a
 fracture zone of 25'-30' wide (?)

⁸²¹
 @ ~ 135' & 10' lower, is a subhorizontal
 fracture zone with close to very closely
 spaced jointing; 1/2" to 5", trending
 342° 40° NE
 approximately 1' wide. surface as trend
 is curved, smooth.

⁸⁴
 @ 105' approx 15' down the rock is
 exposed, 30' across off and on 3' to 5'
 - high

M to N 56' 107° 34° dn ⁴⁶
 - all thick vegetation mat presume
 some talus beneath

N to O 85' 151° 38° dn ⁶⁷
 - ibid.

O to P 13' 64° 20° dn ¹²

W 82-155

Small outcrop 3'-4' above, off & on
 exposed for 25' across. Green-gray fine
 to medium grained diorite. Matrix = 20-25%
 primarily biotite. Very hard to hard,

fresh, slightly weathered on outcrop face - rind.
blocky

JOINTS:

II 42° 82° NW plane, smooth, 6"

- one face of outcrop

~~I~~ III 318° 88° NE plane, smooth

2" to 2', aver. 6" to 1'

- outcrop face

IV 280° 50° N plane to sl. curved,

sl. rough, spacing is 2'

ELEV, 1510' @ 51° @ 56°

23

P to Q 29' 113° 39° W

W82-156 Small outcrop 6' to 10' high, 30'

across trending NE-SW. Rock

is the same as at 82-155

JOINTS

II 48° 84° NW plane, smooth
2" to 1'

I 295° 75° N plane, smooth
2" to 3', aver. 6" to 1'

V 285° 27° - 37° N plane, smooth
2" to >5' aver. 2' to 3'

IV 50° - 60° 5° NW to 15° SE plane,
smooth 6" to 1.5',
strike & dip varies

Q to R 76' 64°

R to UP-L

1479' @ 53° @ -55°

Watawa

2202' @ 6° @ 55°

BRUNTON mirror cracked

Watawa
8/30/82
Geology
8/30/82

8-16-82

It's a foggy morning, looks like it will burn off and be a clear sunny day. Will continue mapping in the upstream portal area. Feels like a fall day.

Watana 2260' @ 7⁰⁵AM @ 45°
2338 7⁵⁰PM
6.5'/hr

UP-3 1531' @ 7²⁵ @ 47°

UP-3 = A

A-B 69' 199° 6° dn 69'

thin - vegetation mat, fairly smooth
Occasional isolated boulders.

B-C 100' 224° horiz 100'

thick - vegetation mat, slightly undulatory, probably talus boulders beneath.

C-D 57' 229° horiz 57'

D = UP-4

1531' @ 7⁴⁷ @ 47°

- thick vegetation mat cover, slightly

undulatory & down slope of rock outcrop at UP-4, presume some talus beneath

D to E 61' 247° 6° dn 61'

- pt is ~ 20' away from yesterday's Pt. Q.

WST - 156

Continuation from yesterday, setup base line from E to F

E-F 79' 116° 28° up 70'

The trend of the outcrops along the base line are 50°-65° across slope.

@ 0.0' go 30' at 250° to the end of outcrop past pt. Q, call it E'

E' to 28.0' on base line outcrop is exposed

@ 15'-23.0' Discontinuous ^{major} fracture zone as a result of the intersection of two small fracture zones

Greenish - light gray fine to medium grained diorite, mafic 20-30%. Rock is fresh to slightly weathered - weathered especially in fracture zones. Hard, FeO staining, Green clay, 5-10%

FRACTURE ZONES:

② 17'-19.0'

325° 85° SW plane to slanted,
smooth 1/10" to 2", aver. 1/2"
very closely fractured zone ~ 2.5'
wide. Width varies 1'-2.5'

③ 21'-23.0'

285° 83° N plane, smooth
1/2" to 6", 1" to 2"
Width ~ 2'

④ 38'-53.0' rock is exposed again
parallel to trend of line - 4' high

⑤ 52' - beyond 79'. At 79' (F) go
at azimuth 50° to SW & 1' on line
NE approx. 20'. Outcrop is approx.
12' high

Same rock no change. A couple of
irregular, discontinuous quartz veins, up
to 1" wide, sharp contacts

Small fracture zone at 63', up to
5" wide, very closely spaced joints

325° 87° NE, vert. plane,
smooth

57-15.0'

JOINTS: @ 63'-70'

IV* 55° 64° SE plane, smooth
2" to 1', aver. 4' to 6" (?)

III 325° 87° NE-85° SW plane, smooth
2" to 3', aver. 1'

II* 50° 45° NW plane, smooth
2" to 3.5' 1'-2'

II* 50° 78° NW plane, smooth
face of outcrop 4" to 1'; 6'-1'

II 60° 62° NW plane, smooth
8" to 3' aver. 3'

I* 295° 78° N plane, smooth
4" to 1' aver. 1'

F-G 26' 272° 28° up 13

G-H 62' 48° 62
- base line for outcrop

W 52-157

Outcrop from 0.0' to 54.0' Greenish-
gray, fine to medium grained diorite. Fresh to
slightly weathered, hard. Outcrop is 10'
to 13' high. Makes 25-30%

@ 21' Felsic dike, light greenish gray, aphanitic to very fine grained. Width is approx 2" to 6", approx orientation parallel to major joint set
320° 75° NE

Fresh, hard, sharp contacts. May pinch out or be truncated, discontinuous

@ 27' Pol of felsic material, 2' spheroidal body. No staining

Joints: @ 15' - 22.0

I * 305° 79° NE plane to curved, smooth, 1/2" to 2', aver. 6".

most are discontinuous, truncated at other fractures.

II * 47° 80° NW plane, smooth to rough face of outcrop; 2" to > 1'

minor { IV 34° 46° NW plane to sl. curved; smooth; est. 4'

IV 90° 26° S plane, smooth discontinuous; 6" to 4', aver. 3'.

@ 37' + 10' below, 2' wide fracture zone. Highly oxidized. Rock is slightly to moderately weathered,

loose. Trending 320° 80° W to vert - dip is questionable. Close to primarily very closely spaced jointing & fracturing. Above in the main outcrop, could not see this fracture zone, partly vegetated

82' 15' a

Joints: @ 38' - 48.0'

I-III 298° - 320° 80° - 85° NE plane, smooth (aver 310°) some are slightly rough; 2" to 3' aver. 1" to 2"

IV * 60° 14° SE plane, smooth 1/4" to 1', aver. 2" - 4" - locally very prominent almost to give the appearance of shaly weathering, especially over a 4' zone.

II 32° 80° - 85° SE plane, smooth, face of outcrop; 1" to 4"

don't find at SW end of outcrop beyond where the 320° fracture zone would intersect it. Visible from 38' to 54'

Base of outcrop.

1620' @ 10° @ 55°

H to I 92' 305° 27° UP 80
 - base line up gully, along the SW side of the gully.

W82-158 (H to I):

Maximum width of gully 25' at base of

17 ft = Joints - three major sets

II 045/82 SE

2nd open joint, major set
 vert to cl spaced

IV 065/22 SE

planes, smooth, sp 1/2 to
 6 in, or 2-4 in

I 305/75 to 85 NE Face of
 gully, planes, smooth to
 slightly rough, blocks
 breaking away from face.
 along this set also seems
 to have controlled
 hydrothermal solutioning
 here.

17 up Rock is generally the same

as at W82-157 but with
 zones of alteration parallel to
 the 305 joint set. West side
 of gully is riddling off in
 blocks from 6 in to about
 18 in wide. The rock is slightly
 to occ in moderately weathered
 altered. All joints are very
 close to close spaced. Local
 zones of soft friable rock

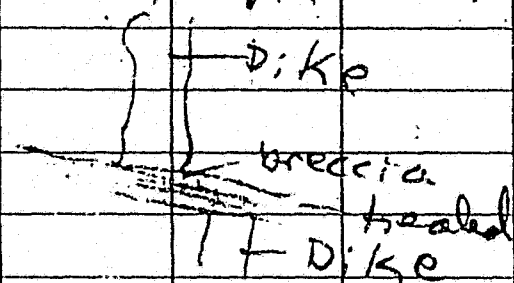
52 ft

Felsic dike, light yellowish
 white, very fine grained,
 almost aphanitic, some
 visible quartz and feldspar
 grains, predominantly
 feldspar, hard, fresh.
 Fels staining on joints.
 Fractured like the surrounding
 diorite.

trend of dike is uncertain
 because of shearing and
 brecciation. Width is

about 1 ft (?) with a
trend of 050/83 SE

Dike definitely sheared along
the following healed
shear 325/20 SW, offset 1 ft
and possibly along the
305 joint set.
The 325/20 SW shear planes
are very close spaced



52 to 66 ft

The dike separates what appears
to be a change from the
diabase in the lower gully
from healed diabase breccia
above. Joint characteristics
change from the 3 well defined
sets below to primarily
subparallel to the 325/20 SW
shear

69 ft

Fracture zone, about 5 ft
wide, 030/83 SE, aligns
with depression on east wall
of gully, very close spaced
joints along trend and also
subhorizontal set described
above

@ 78' - 82'

- gully lines up with one on the other
side, 045°. Maximum width
- fracturing is visible adjacent
to both gullies on either side
of the main gully.

H to J	33'	332°	25° UP	30
J to K	60'	38°	90° UP	54

W82-159 (J to K)

On the NE side of the gully, around the nose of the ridge which makes up the NE side of the gully. Rock is the greenish-light gray, fine to primarily medium grained diorite. Hard, fresh to slightly weathered, close to very closely fractured, jointing is close to moderate close.

Many of the joints / fractures are CO_2 stained. Outcrop from 70' - 60.0', averages 15' - 20' high. Trend of exposure is parallel to J-K.

@ 39.0' - 47.0' small gully in the outcrop on the NE side part of the rock face has the shattered appearance. Very closely spaced fractures generally CO_2 coated. Probably fracture zone along the trend of this gully trending probably

$320^\circ - 325^\circ$ $63^\circ - 78^\circ$ NE

Nothing is visible on the SW side of gully. Maximum width ~ 7'.

Or could possibly be the intersection of three sets 320° , 413° , 26° of close to very close jointing / fracturing. No topo expression above.

JOINTS:

III * $320^\circ - 325^\circ$ $63^\circ - 78^\circ$ NE plane to pl.
wavy, smooth 1" to 6"

IV 52° 28° SE plane, smooth
6" to 1"

IV * 43° 41° NW plane, smooth
3" to 1" aver. 6"

II * $26^\circ - 28^\circ$ 74° E - 86° W plane, smooth
2" to 6" aver. 4"

@ 50' Open joint 2" to 4" wide
 328° 87° NE. Filled w/soil

K to L 57' 8° 24° up
@ 41' trend go at 240° for 21'
to end outcrop, then it
proceeds upslope to above the
previous outcrop. Exposure ~ 6' high
+ directly upslope from K ~ 20' high
there is a 3' wide fractured zone
that may be discontinuous & isolated
probably part of fracture
zone mapped ~ 50 ft west
Trend is $310^\circ / 40^\circ - 46^\circ$ NW

joint planes are planar to slightly curved and smooth spacing $\frac{1}{4}$ in to 3 in. avsp 1 to 2 in. rock is heavily CO_2 stained and appears fractured
Dip of zone may be low due to slumping

Pt is approximately at 50' on segment J to K

JOINTS on main outcrop from 37' to 15' to the SW.

major joints

II 45° 77° NW plane, smooth, face of outcrop; 2" to 2' av. 1' to 2'?

IV 79° 46° N plane, smooth 8" to > 3'; av. 1' to 2'

~~II~~ 280° 59° S plane to irregular smooth; $\frac{1}{2}$ " to 6"; av. 4"

III 325° 66° NE plane, smooth 1" to 3'; av. 1' to 2'

- small fracture zone at 29.0'; 8" wide

very close to close spaced joints & fractures

L to M 81' 14° 27° UP ⁷²

1735' @ 2° @ 65°

M = UP-2

1673

EL

1673 M to N 58' 320° horiz. ⁵⁸

see W82-150

EL

1685 N to O 23' 321° 33° UP ¹⁹

- rock exposed at 6.0 - 14.0' in a N-S direction, across slope

O' to 43' 30' 6° horiz

43' to P 57' 12° horiz

- so O' to P = 87', there is a slight bend to the line

- O' = 0.0'

O = 30.0

P = 87.0'

O' - P 87.0'

W 82-160 (O'-P).

Rock is exposed almost continuously across the upper part of this gully. from 0.0' - 87.0'. It's the "Y" shaped gully.

@ -5.0 Open joint filled with 1/2" sand. Approx. 3" to 4" wide.

Oriented 48° 85° NW

No evidence of shearing or fracturing.

All surrounding joints are tight.

Rock is the greenish-gray, fine to medium grained diorite. Mafics 25-30% biotite & hornblende. Hard to very hard, fresh to slightly weathered, blocky.

JOINTS: @ 0.0' to -3.0

II 40° 85° NW plane to sl. irregular smooth; 1" to 6"; aver. 4" to 5"

- 50% are open to 1/4"

- open joint at +3.0'

~~I~~ III 315° 73° SW plane, smooth to rough face of outcrop; 6" to 1'

IV 320° 51° NE plane to sl. curved, smooth; 8" to 1'

- spacing increases towards North. At 13' it is 1" to 2"

@ 30.0' outcrop is 8' above line & is 10' high

161 @ 47' Fracture zone may be closed & discontinuous. Very close to closely spaced joints. Approx 1.5' - 2.0' wide

268° 37° N, 1/4" to 4"

Just below the following joints

~~I~~ II 320° 85° NE - 85° SW plane to irregular; 1" to 6"; aver. 4"

~~I~~ III 22° vert plane smooth to sl. rough, face of outcrop; 1" to 6" aver. 2" to 3"

II 60° invert. plane to sl. curved smooth; 1" to 1.5'; aver. 6" to 1'

IV 60° 18° NW; curved-irregular sl. rough; > 18" over.

- irregular south side of outcrop

@ 48' Fracture zone with an 325° 77° NE 1" to 3"

approximate width of 1' to 1.5'

FeO staining. Very closely fractured

and jointed, slightly weathered

(a) 73'-87' almost no exposure of rock

@ 77'-80' diorite, reddish orange slightly to moderately weathered, moderate hard, intense FeO staining, loose blocks.

- this is crossed by a dike ~ 5" thick, felsic dike. Light orangish gray, fine grained. 15-25% quartz; rest is feldspar penetrated FeO staining, slightly weathered. Oriented $352^{\circ} \quad 40^{\circ} \text{ W}$

Dike is highly fractured along closely spaced joints

Joints: are approx

I $275^{\circ} \quad 68^{\circ} \text{ N}$ plane, smooth, 1"

II 42° vert. plane - sl irregular, smooth 2"-8", aver. 4"

$15^{\circ} \quad 74^{\circ} \text{ N}$ plane, smooth 3" to > 3', aver. > 2'

Elevation of the base line is on the order of 10' above VP-2

P to Q

34.5'

770

E 11.5'

0.0 - 29.0'

bedrock cliff

20'

to 25' high

B 4t

Dike, felsic, light gray, fine to medium grained, mostly fine (5 to 10% mafic (very fine grained), very hard, fresh, trend ~ 030/62SE (primarily feldspar) vesicular to close spaced fractures FeO stained and some with CO₂, 6 in wide

16c

At top along 013/42 SE drag fold on dike, offset of 16 in, very sharp contacts, dike up to 3 ft on either side is highly fractured (N. cljt)

many of which are CO_2
 filled, slightly weathered,
 moderately hard to hard

18 ft

Diorite, greenish gray,
 medium grained, 25 to 30%
 mafic (biotite probably no
 hornblende), hard & slightly
 weathered, FeOx stained,
 rock is fractured (vertical)
 but appears "healed" tight,
 CO_2 on some joints

Joints S?

IV 225 / 53 NE

planar to al curved, smooth,
 sp 3 in to 18", av 8 to 12 in,
 tight, but dip toward river

II 036 / 62 NW to 70° NW

planar, smooth to al. rough
 sp 1 in to 1 ft, discontinuous

I 273 / 83 to 86 N face
 irregular, rough
 sp 4 in to 1 ft

III 327 / 90

planar, smooth
 sp 2 in to 1.5 ft, av 6 in to 1 ft
 oriented 320° is

(c) 20' A foot wide gap between two
 rock pinnacles. There are slump
 blocks in front of it. Beneath the
 base line at the same point is a 1'
 wide shear zone with 1/2" of sandy
 silt zone, very closely jointed, oriented
 315° 80° NE

The rock is outcrop has many open
 joints and therefore loose unstable
 blocks. Open joints are along 320° and
 273° sets

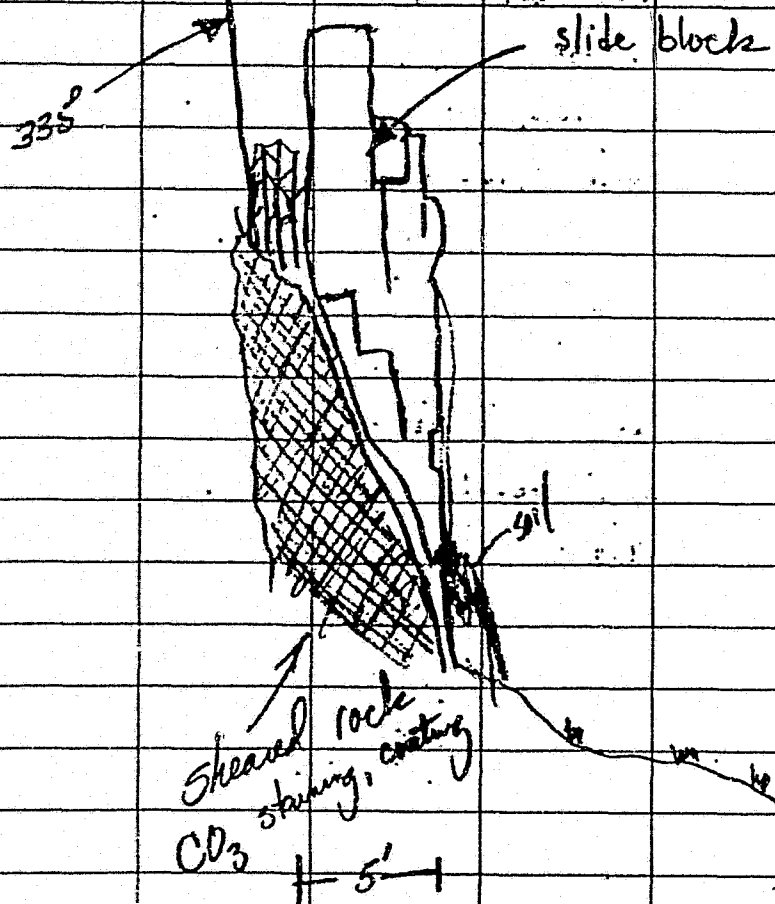
Q to R 59' 345° 10° SE

W&Z-161

K&Z-4;0,-1

On the same rock ridge pinnacle except around to the river side. Several shear zones are exposed at acute angles to the line.

@ 58.0' is the southwestern 15' high slide block which has fallen adjacent to a shear. It has a curved, smooth failure surface



@ 40'

~8'

Rock in between the so far found two shears is closely spaced jointing. Has the highly fractured, shattered appearance.

@ 30'-40' (acute angle to line)

Two - four feet wide shear zone bounded on either side by shears - west side one - is 6", silty-sand zone / breccia, yellow orange, FeO staining

- east side - is 3" wide

primarily a breccia w/ sand & gravel size particles, yellow-orange to light gray

- between the two shears, rock is fresh to slightly weathered, hard, tight joints, close spaced joints - 305°-320° vert. - orientation of shear zone.

- spacing of the jointing over 1"

joints: - adjacent to shear zone

III 330° vertical; plane smooth <1" in shear zone; 2" to 1" over 8"

II 60° 85° SE plane, smooth
 < 1" in shear zone, forms a
 rock face; 1" to 1'; aver. 6" to 1'
 V 65° 25° SE; plane - irregular,
 rough; 2" to 3', aver. 6"
 - sampled the gouge

@ 39'-58' (acute angle to line)
 Very closely spaced fracturing through-
 out, shattered appearance, heavy carbonaceous
 coating on sheared material, some thin
 seams ~ 1/8" of gouge found, greenish-
 white and yellow orange sandy-silt w/
 some clay, rock fragments. Orientation
 of joint w/i

330° 86° NE plane, smooth
 discontinuous

The large outcrop face has a 335°
 orientation. Slide block appears to
 have fallen from above the sheared
 material. Appears to be altered
 Spacing is 1/4" to 4"

Watana

2338' @ 7° @ 55°

Right above the diversion tunnel
 portal there are several shears oriented
 ~320°. The rock in between is of fair
 quality as it is highly fractured & poorly
 healed (shattered appearance). It appears
 that much of the area will be incorporated
 into the "Fins" shear zone.

11th
 Traverse 19/27/82 K.S.D.
 9/29/82
 9/29/82

8-18-82

It is very foggy this morning,
it will probably burn off shortly
and be mostly sunny for the rest
of the day. Will continue mapping
in the upstream portal area.

Wataona:

2260' @ 6° @ 40°
Couldn't get out until 10⁰⁰

UP-2 1667' @ 10° @ 60°

Pt. R. 1685' @ 10° @

8-16-82

W82-161 (cont)

@ 14' Small shear up to 4" wide
85° vert

Breccia, altysand, reddish brown
with gravel size pieces of diorite

severely weathered, friable. Can
line up with opening in rock cliff
above, & notch in rock below

166

Fracture, from 44 to 54 ft.

315 / 32 SE (R)

irregular surface, smooth to
slightly rough, friable zone
2 ft thick (approx) breccia

UCL from partially
sealed by CO₂, no more
truncated by slump block
at end of this traverse and
covered by veg on W end

joints above shear appear to
be more closely spaced than
those below, zone truncates

eastern shear described above
Photo K4-3

closeup of fracture zone

R to S 21' 028° horiz²¹
 S = east side of gully

Gully at 10', trend is 340
 parallel to NW shear from
 last traverse, possibly slumped (?),
 gully is later filled
 joints from west side

62-16a

IV 078 to 098 / 35 to 42 N
 planar, smooth
 sp 1 to 8 in

II 042 / 70 NW
 planar, smooth, discontinuous
 sp 1 in to 1.5 ft, or
 3 to 6 in

16a Shear fracture
 300 / 36 NE
 discontinuous

III 327 / 83 SW face of gully
 planar, smooth
 sp 1/2 in to 3 in next to
 gully; spacing 4 to 6 in
 4 ft west of gully

joints from east side

II 035 to 042 / 68 to 71 NW
 planar, smooth
 sp 1 in to 6 in, or 2-3 in

IV 012 to 030 / 18 to 20 ESE
 planar, smooth
 sp 0.5 to 6 in, or 4 in

IV 060 / 62 SE
 planar, smooth
 sp 1 in to 3 ft
 discontinuous

Digging in gully reveals
 angular rock fragments
 up to 2 in, and silty sand,
 weathered tan, breccia (?) not
 to light chocolate brown.

typical of breccia & gouges found
here, 4 in exposed, possibly
up to 12 in wide; silt is
lightly plastic. total zone
affected by shear is 4 to 5 ft
wide.

S to T 13.5' 36° 41° ¹⁰ UP

T to U 36' 326° ~ horiz ⁵⁶

- on the river side of the last block
with shear separating two large
blocks. Traverse ends at the side of an
approx. E-W gully.

- all along the face of this block
is pronounced jointing along the
20°-42° set

JOINTS:

¹⁶ II 20°-42° 18°-30° E-SE
curved, smooth
1/2" to 6"; aver. 2"-4"

part open, loose
II 45° 70° NW plane, smooth; 1" to 15"
aver. 4" to 6". 50% are open to
maximum 1/10".

III 338° 85° SW plane smooth; face
of outcrop 1/2" to 6", aver. 2"
~ 50% are open

FeO staining on all joints

⁵⁷
P to V 74' 318° 40° UP
- rock cliff exposed along entire
length from

¹⁹
V to W 23' 35° 35° UP

¹⁶ Very Irregular, subhorizontal, curved,
open joint. May have been sheared but
difficult to tell. Filled with wash &
possibly some breccia (?). Orientation
of irregular surface?

70° 113° N
330° 16° SW
20° 40° SE

main trend
subparallel
a joint

Filled with silty sand, some rock fragments,
CO₂ coating. Opening is 1" to 6"

W to X 49' 330° 36° UP.. 4D
X = 1790' @ 125° @ ~62°

@ 23' Very highly fractured, old shear
zone oriented:

316° 85° SW to vertical
Width = 1' to 1.5'. Very closely
spaced fractures, Intense iron
oxide staining, slightly to
moderately weathered. Locally
friable.

- east side is a 1/2" zone of
breccia &/or gouge. - silty-
sand material, light brown
to orange brown. CO₂
staining

@ 36' : on the other side of
rock cliff face is a Gouge/
altered zone the gouge zone is
a minimum of 8" wide, its a

sandy-silt with some clay, light
yellowish orange or orangish brown
There is also ~6" of disintegrated
rocks, breaks into coarse sand,
the trend for this to fit through the
notch in the rock cliff would be
between ~305°-315°. Adjacent rock
appears to be altered. Approx width
(maximum is 18" to 2') Rock is
Fe & CO₂ stained

W 82-162 (X)

The entire rock mass to the NE has
moved relative to the western or main part
of the topography. There is an open joint
1' wide with an irregular surface. The
SW rock mass has an irregular, undulating
joint surface, oriented 315°/47° NE

16C slickensides strike 295°/5° NE
on joint surface with
movement of northeast
block from west to east

X-Y 42' 253° 40
19° UP

0.0' - 18.0' Shear/fracture zones
cross the line.

Started a landslide down the
chute.

Comment to SNT: "SURE IT'S
STAYE..... RELAX
TAKE IT EASY"

- rock exposed continuously along
the north side of the line, the
south edge of the E-W gully

Y-Z 82' 268° 34° UP

- the entire ridge up from X, is
loose blocks, real stable for
a portal!! No problem.

- rock outcrop is visible across
the top of the gully at least part
way.

Z to AA 100' 317° 26° UP

- still no rock exposed on upper
surface, but is exposed 15'
to the N-NE at the top of

the gully on this side

AA-BB 88' 317° 22° UP

- outcrop just below BB, up to 10' high
30' across.

Dark green, medium grained diorite
Some fine grained x-tals. Maybe 15-25%
biotite, maybe some hornblende. No visible
quartz. Fresh, very hard to hard. Outcrop
has a loose fractured appearance. A
couple of large boulders 8'-10', subrounded
are at the surface above this exposure.

Joints: - from loose outcrop

~~II~~ III 315° 85° SW plane to sl. curved
north; face of outcrop
2" to 1.5'; aver. 6" to 1"

II 48° 75° NW plane, sl. rough
2" to 1.5', generally 6" to 1"

IV 350° 30° E sl. irregular -
plane, sl. rough; 1" to 18"
aver. 6"

BB-CC 59' 2° 13° UP

- adjacent to is a 8' in diameter boulder 95% moss covered
Several other granitic boulders protrude slightly through the vegetation mat.

CC-DD 85' 62° 7° dn
1938' @ 35° @ 58°?

@ ~20' - 85', ~20' lower than elevation, for 15' high is continuous rock outcrop. Below DD it is continuous bedrock from cliff edge to the river. Rock is a greenish-light gray medium grained diorite. Plagioclase comprise

JOINTS: @ 25'

I 304°-306° 71°-76° SW plane, smooth; 3" to 1.5', aver. 1'

II 346° 32° E sub irregular, smooth 1' to 2.5'

III 42° 76°-83° NW plane, sub smooth; face of outcrop 2" to 1'

25-30% biotite & hornblende. Massive,

hard to very hard, fresh

JOINTS (cont)

IV 30° 25° SE sub irregular, smooth 6" to 2.5'

@ 65' below cliff to SE

Shear 325° 85° SW to vert. sub curved, width 1/2" to 6" of breccia, CO₂ filled - spacing 6" to 1'

Most surrounding rock is competent. Some open joints - only problem with the rock here as the shears are minor

@ 37'

Small shear which splays. Splay is younger than main zone, 10" apart. Younger is not healed silty sand breccia. OLD SHEAR

305° 78° SW old - fracture and shear zone 1/2" to 2" wide. Breccia healed with CO₂. Moderately weathered locally friable

Rock between the shears is good quality.
Close to moderately close jointing. Several
of the joints are open.

JOINTS: (between shears)

IV 45° 25° SE plane to sl. curved,
smooth; 4" to 1.5' aver. 1'

II 40° 80° NW sl. curved, sl. rough;
face of outcrop; 6" to 1'
- some open to 3/4"

DD to EE 98' 284° 17° UP ⁹⁴

- isolated boulders 2' to 3' in
diameter beneath the vegetation
cover.

100' 232° 2° UP

EE to FF 59' 167° ⁵⁹
- 5' elev
(no veg. topog)

FF to GG 100' 170° 24° ⁹¹ _{down}
- occasional boulder beneath the
vegetation mat

GG to HH 100' 148° 24° ⁹¹ _{down}

HH to II 98' 114° 27° ⁸⁷ _{down}
@ 220° 35' over bedrock is
exposed on top edge of gully
for ~ 40' upslope

II to JJ 100' 116° 27° ⁸⁹ _{down}
- scattered boulders beneath the
vegetation mat ~ 50% covered somewhat
irregular surface

JJ to KK 84' 159° 37° ⁶⁷ _{down}
- ibid

KK to LL 60' 213° 58 13° dn
at bedrock on the NE side of
the gully. Can see UP-1

LL to MM 99' 80° 90 25° dn
@ 80'-99' crossing an outcrop
which is above & below us, & continues

W82-163

STATION which we visited earlier
a little lower in elevation and SE of MM.
Rock has a shattered healed appearance
from 80'-99'. Green-gray, ^{fine to} medium grained
chlorite. Very hard.

see (82-151)

JOINTS:

~~III~~ 327° 85° SW to vent.

SW face of outcrop

- are some open joints parallel
to this face up to 4" wide

I 320° 85° NE plane to curved;
smooth, ~50% are discontinuous
2" to 1.5'; aver. 6"

II 58° 78° SE, irregular, smooth to
south-facing exposure, ^{sl. rough}
2" to 1.5'; aver. 6" to 1'
IV 300° 15° NE curved, smooth
½" to 18"; aver. 6" to 1'
- an old healed shear, 1" to 2"
wide, CO₂ filled, very closely
spaced fracturing, moderate
hard.

MM to NN 54' 102° 40 42° dn
- came down across outcrop and
now at the base

NN to OO 38' 19° 32 33° UP
- outcrop ended @ approx 26'
along this segment

OO to PP 20.5' 53° 19 20° dn
PP = UP-2
1678' @ 63° @ 58°

Waxana

2242' @ 64° @

Transverse plot 9/29/82
Geology plot 9/29/82

8-19-82

It's a clear sunny day. Will continue mapping in the upstream portal area

Watana 2260' @ 65' @ 45°

UP-5 1491' @ 72° @ 44'

UP-5 = A

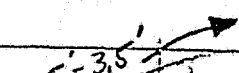
A-B 33' 38° 5° UP ³³

- base line across slope, rock cliffs above

@ -5.0' to 10.0' massive rock with open joints along several of the joint sets.

JOINTS:

I 282° 65° S plane

2.5'-3.5'  III 5° sh. rough, part open

II 50° 66° SE plane,

smooth open, up to 4"

III 50° 57° NW plane, smooth
open to 2"; 8" ± 3.5'
over 2.5'

- joints open probably due to some slumping of the rock.
- Quartz diorite, fine to coarse grained, primarily medium. Quartz 5-15%. mafics 25-35%, ~50% biotite anhedral; hornblende anhedral FeO staining. Rock is fresh to slightly weathered, hard, massive, competent.

@ 13.0' to 23.0'

42° 73° NW plane, smooth face of outcrop

@ 24.0' - block has slumped, open joint behind 68° 10° S, open 6" to 8" filled with silty sand, soil. Walls of are CO₂ stained. - block is 6' wide

@ 28' rock face which trends uphill start here; oriented 315° 75° NE

@ 28' - 42' - no rock exposed at this elevation only higher up

@ 42' - ~50' rock is exposed

B to C 40' 327° 29° UP
 - rock extends approx. 15' upslope
 along the same azimuth before
 it intersects the adjacent gully
 elev. @ C
 1523' @ 83° @ 50°

JOINTS, along rock face
 315° 75° NE plane to sl.
 curved, rough due to weathering
 spacing is 4'
 - 1 1/2" layers of weathered, rotten
 rock

072/55 SE
 planar, smooth to rough
 sp 1 to 3 ft, gen 3 ft,
 25% open to 1/4 in, gen with depth

038/82 NW
 planar, smooth
 sp 6 in to 4 ft, only local
 minor set

070/28 NW
 planar smooth, open
 sp 6 in to 4 ft, or 3 to 4 ft

@ 25'-30' - Some locally discontinuous fractures
 along 072°, averaging 1' long
 with a spacing of 2"

A to D 59' 180° 7° UP
 W 82-164 (A-D)

- due west of UP-5; @ 0.0' ± approx.
 20' up a 3" clay gouge zone
 is exposed. It is a orangish brown
 to light yellow-orange sandy clay
 Moderate to high plasticity, no rock
 fragments, no fracturing associated with.
 304° 75° NE

Joint faces bordering are CO₂ stained
 moderately weathered/alted and
 ~ 1/2" (?) thick, exfoliation

5' east another shear, pale brown (whitish
 tan) breccia zone. Sandy-clay
 gouge, moderate to high plasticity
 with occasional rock fragments of
 slightly to moderately weathered/
 altered rock. Width is ~ 5' to 6'.
 Oriented 330° 84° SW to vert.

- no fracturing or jointing are associated with either of these.

@ 11'

- old shear oriented:

70° 50° SW

zone is 1" to 2" wide, partly healed. Breccia is primarily a fine gravel. Moderate hard to soft. Can dig breccia out with pick but is not soft enough to dig by hand. Within breccia is a 1/4" layer of silt sand gouge. Along a major joint set

JOINTS:

I 70° 50° SW plane, smooth
6" to 5'; aver. 3' to 4'

II 38° 65° NW; plane, smooth
3" to 5'; aver. 3' to 4'

III 330° 80° NE to vert. 8" to 3'; aver. 1-2'

- face of outcrop

- plane - sl. curved, smooth

- intersects the line at 31.6'

@ 44' Very massive portion of outcrop
Freezing & thawing has loosed blocks
up to 5' across

JOINTS

I 32° 59° NW plane, smooth
2"-5'

II 342° 37° NE sl. irregular to
plane, rough; $\geq 5'$

III 330° 46° SW plane, smooth
 $\geq 4'$

Going up chute.

D to E 37' 249° 33
26° up

- west side of gully

- dike exposed in rock ~ 15"

wide. Light gray to light reddish gray, very fine grained felsic dike. Approx 40% quartz.

Mafics 2-5%. Fresh to slightly weathered, hard to very hard. Dike is more fractured than surrounding rock.

51° 85° NW

The southeast start is a joint. the NW contact is a shear, parallel to dike, 1" to 1.5" wide, silty-sand breccia, yellowish orange

E to F 35' 299° 37° up
 ELEV. 1564' @ 11° 05' @ 64°
 @ 35' middle of gully
 85° 83° S

very closely jointed 1/4" - 4";
 yellow orange brown 1/4" wide &
 1/2" wide. Zone is 3' across

Exposed at steep in bedrock

@ 0.0' north side; open joint;
 4° 85° E to 85° W

curved, smooth; 4" to 6" wide
 filled with soil & rock fragments

D to G 31' 176° 7° dn 31
 @ 3' to 26' is the main part
 of the gully, some bedrock exposed
 @ 31' @ bedrock

G to H 42' 151° 31° dn
 - followed bedrock around to the river side.

W 82-165

On bench above river with rock exposed above and below us. Rock is a light gray fine to medium grained, quartz diorite. Fresh to slightly weathered, hard, massive outcrop. CO₂ staining along many of the joints.

Joints:

II 79° 67° S plane to sl. irregular
 sl. rough 2" to 4'; aver. 2'

@ 33' & 35' there are shears
 along these joints, with 1/2" to 1" thick, respectively, breccia.
 Medium hard to soft

I° 75° E plane to sl. curved, sl. rough,
 face of outcrop, aver. 1"

IV 15° 34° W plane to sl. curved,
 smooth 6" to 5'; aver. 3'-4'
 ~ 25% are discontinuous
 - overhangs

42° 65° NW plane, smooth
6" to 3', aver. 1'

IV 290° 22° N plane to curved
1' to 1.5', only 2', outcrop
overhangs & may have slumped
down somewhat

(c) 22' Small shear oriented
80° 72° S Generally
3" wide but up to 5" to 6"
Mostly a silty sand breccia with
occasional layers of clay, light
brown to yellowish orange
Occasional rock fragments
coarse sand size. Possibility
that east side block may have
slumped, the opening is
wider at the top.

Photo K82-3; 6

(d) ~8' Small shear, oriented
65°-80° 60° SE
Approx. 1" wide of silty-sandy,
sand, yellow orange.

Just going no fracturing

38
H to I 40' 196° 17° UP
@ 25' rock exposure turns
up slope

JOINTS: on rock face above @ 30'-40'

III 337° 85° NE plane, smooth to sh. rough
face of outcrop; 2" to 6'; aver. 3"
II 60° 75° SW plane to sh. curve
rough; 6" to 3'; aver. 2'.

- are discontinuous in lower
part of the outcrop

350° 60° E irregular-curved,
rough; undulated surface
which follows dips; 2' (3')

- upper one is open to 1/2"

IV 328° 20° NE plane to sh. irregular
smooth; 4" to 10'; locally
fine in the feet

- may be part of the 350° set

I to J 76' 207° 21° UP 71
J- UP-B- 1566' @ 10°

Transverse plot 9/29/82
containing plotted 4/5/82 { K. 1 W

River level, will start up chute

1496' @ 2°

- dangerous walking conditions will make an attempt

1564'
@ ELEV. 1599' @ 3° @ 63°
- on the SW side of the chute

- a shear zone oriented (estimate)
 337° 79° NE

Has a 4"-6" breccia gouge zone. Has a pale green & pale brown clay gouge up to 1" wide, the green one is a seam. Up to 4' to the NE & 2' to the SW the rock is closely to very closely fractured & is moderately to highly weathered/alt. CO_2 coating

- @ 8' below excavated 3' wide area of clay gouge. Could be slope wash or gouge; Not sure of orientation & therefore it affects actual width
- probably parallels the one described above.

is heavy. Many open joints, surrounding rock is loose, incompetent at least locally in this zone. Not sure if this highly weathered/alt. material follows the shear zone or is just a local feature.

1574'
@ 30' above last one (1630')
Shear oriented
 298° 72° S
Width is 5". Consists of sandy clay or silt gouge/breccia. Moderately plastic. Yellowish orange

@ 1649' @ 35° @ 63°
Possible shear zone / alteration zone
 315° 65° SW - assumed trend, ??

Minimum 3.5' wide altered or sheared breccia material. Ranges from a silty-sand to sandy clay. Fragments of altered & unaltered diorite, up to 2" yellow orange to reddish orange.

Difficult to determine orientation or to line up with topographic forms.

Rock adjacent to is moderately altered (?) weathered. Old shear through it,

270° S

Approx 2" width of breccia

Across the way, same elevation:
some H₂O is seeping out of hill ??

Estimate that approx 100' along slope above, 50'-60' elevation wise) rock appears to be continuous across the chute. All loose blocks; close to moderate close.

To dangerous to go higher, even if our salaries were too high!

59

1649

Photo K82-3, 1649, 60' high

30'-50' from top { joint spacing is close to moderately close near surface, below it is moderately close to wide

I Major low angle face in the photo on SW side of chute

315° to 0° 65° E to S

curved, smooth to slightly rough, > 2'

- face is black in the photo

- could possibly be two joints

Other joints:

II 35° 65° NW plane, smooth

1' to 3' aver. 2' to 3'

III 330° 85° NE to 85° NW; plane, smooth to sl. rough; 1' to 5'; aver 2'

- subparallel to lower portion of chute

Going back down, large felsic dike is exposed on the SW side of the chute. Light yellowish gray. Fine to coarse grained. Primarily fine grained. Quartz is 5-25%. No visible mafics. Penetrative iron oxide staining. Fresh to slightly weathered, sand & brittle. Very close to close spaced fracturing, more so than adjacent rock. Oriented

345° 83° SW

Approx 2' to 2.5' wide. Some shearing
is associated with the NE side contact
going $\leq 1/2''$ ELEV. 1566' @ 45°

On the NE side of chute, the dike
& a shear are exposed. Dike oriented:
330° vert.

Is approx 3' wide, no shearing assoc.
with contact. One foot to the east
is an alteration zone that has been
sheared, 6" to 8" altered diorite with
many shear planes in $\sim 1/10''$ apart.

Shear orientation is:

330° vert

Location is 5' to 7' higher.

Two Photos of Dike

K82-~~8, 9~~ 10, 11

Returned to river

1522' @ 45°

1478

PHOTO K82-~~8, 9~~ 10

- south bank of the v/s copperdam

Watana

2308' @ 54° (approx 60°)

(intercrop plotted 9/29/82) 1-11

(see K82-11 v/c plot 9/11/82)

8/20/82 Sunny, warm
Laid out a new route
end to S (82) - A per
archeological clearance
requirements.

New end is offset 310 feet
@ 330° from old endpoint.
New section trends 1065°
for 950 feet, where it
intersects original line.

Spent rest of day plotting
data.

8/21/82 Partly Sunny, warm
K.W. Spent Day on south
bank at location for
proposed upstream cofferdam

Laid out base line from
5481-5 for 200' at $0/0^\circ$
and 200' at 190° from mid
point on gravel bar

$0/0^\circ$

0-27'

Soil 1 - Sand, uniform,
fine, less than 5% fine,
medium gray 1 to 1.5 ft
exposed, overlies gravel 1,
marking down slope from
abandoned channel area
to south

Underlain by

Gravel 1 - Sandy gravel,
well graded, fine gravel to
4 ft diameter boulders.

generally 2 to 6 inches,
subangular to rounded,
generally subrounded,
15 to 25% fine to coarse
sand, medium gray,
moderately dense.

Photo K 82-4-16

Constituents are primarily
fine to medium grained
"granitic" and metamorphic,
also some fine grained
volcanic and sedimentary rocks.

30 to 75 ft

Sand 2 - Sand, uniform
very fine, less than 5% fines
up to 1 ft thick, but generally 6 in
overlies gravel 3 in
scattered areas, probably
also interbedded with Gravel 3

Gravel 2 - Sandy gravel
poorly graded, similar
to Gravel 1, but missing
coarse sand fraction,

probably a subset of gravel 1

75 to 200 ft and continuing
northward along gr. 2 bar

Gravel 3 - Sandy gravel
well graded, fine gravel to
boulders, 4 ft max, generally
6 to 12 in, 5 to 15% sand,
less than 5% fines, cobbles
greater than 4 in tend to be
mostly the medium grained
granitic types, those less
than 4 inches are generally
the fine grained volcanic
and sedimentary rocks. Prob.
the effect of grain size on
rock fragment size.

Assume that surface is
a boulder pavement.

More than 95% of fragments
appear fresh and stable.
Cobble size tends to inc. towards
the river.

Photo K 82-4-17

Sand 3 lies on east side of gravel bar along western edge of subsidiary channel

Sand to silty sand, uniform, very fine grained, 0 to 20% silt, generally less than 10%, medium gray, dilatant potential liquefaction

nealy silt size

Gravel 4 lies along the south bank on the east side of the subsidiary channel

Gravel 4 - Sandy gravel well graded, fine gravel to 2 ft boulders generally 4 to 6 in, approx 10 to 20% sand, FeOx staining on most fragments, 5 to 10% variable rock

fragments, primarily metamorphic breaking down along cleavage planes. Also some red grained granites decomposing along grain boundaries beneath tundra mat. Size of boulders increase dramatically where sand 1 appears (see map)

Photo K82-418

Sand 1 and gravel 4 seem to be part of the abandoned channel between the 1st and divide bedrock to the south. The material is washing down the slope and mixing with the alluvium from the gravel bar.

The southwestern portion of the Coffman site is underlain by Talus consisting of fine gravel to boulders up to 3 ft. at river level this material averages 6 to 8 in further up slope. Blocks are

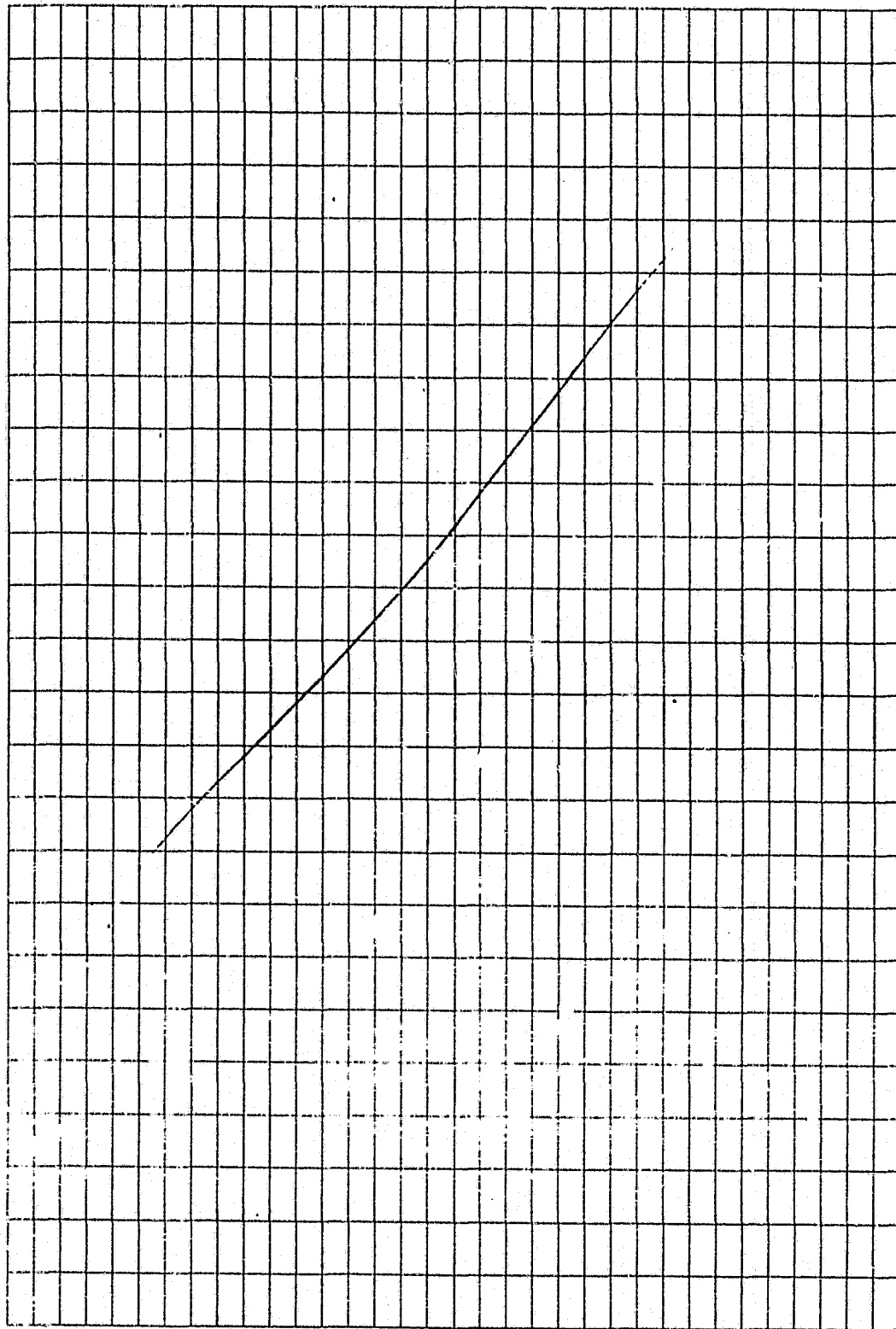
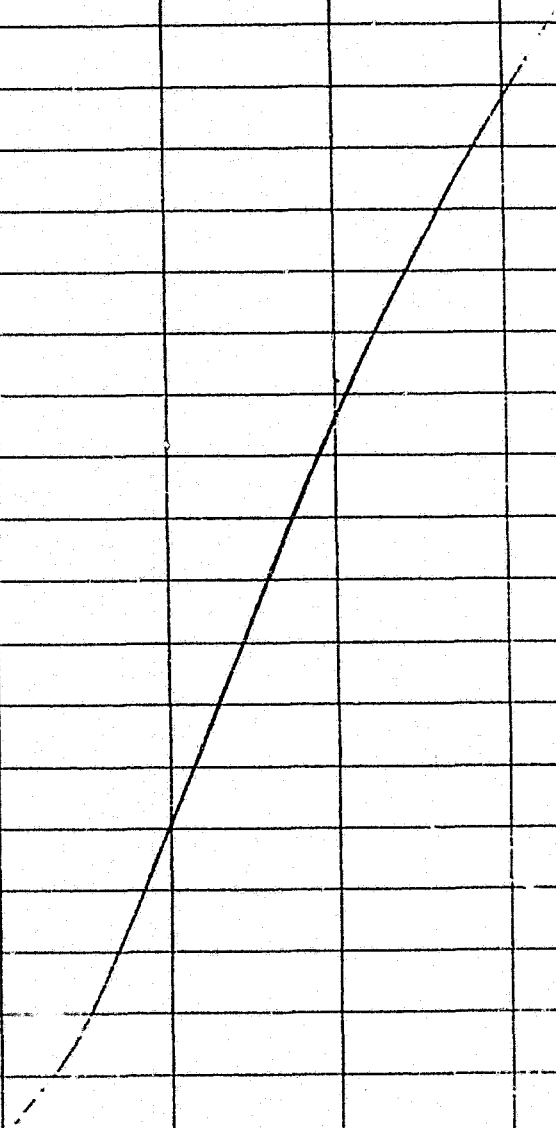
K82-419

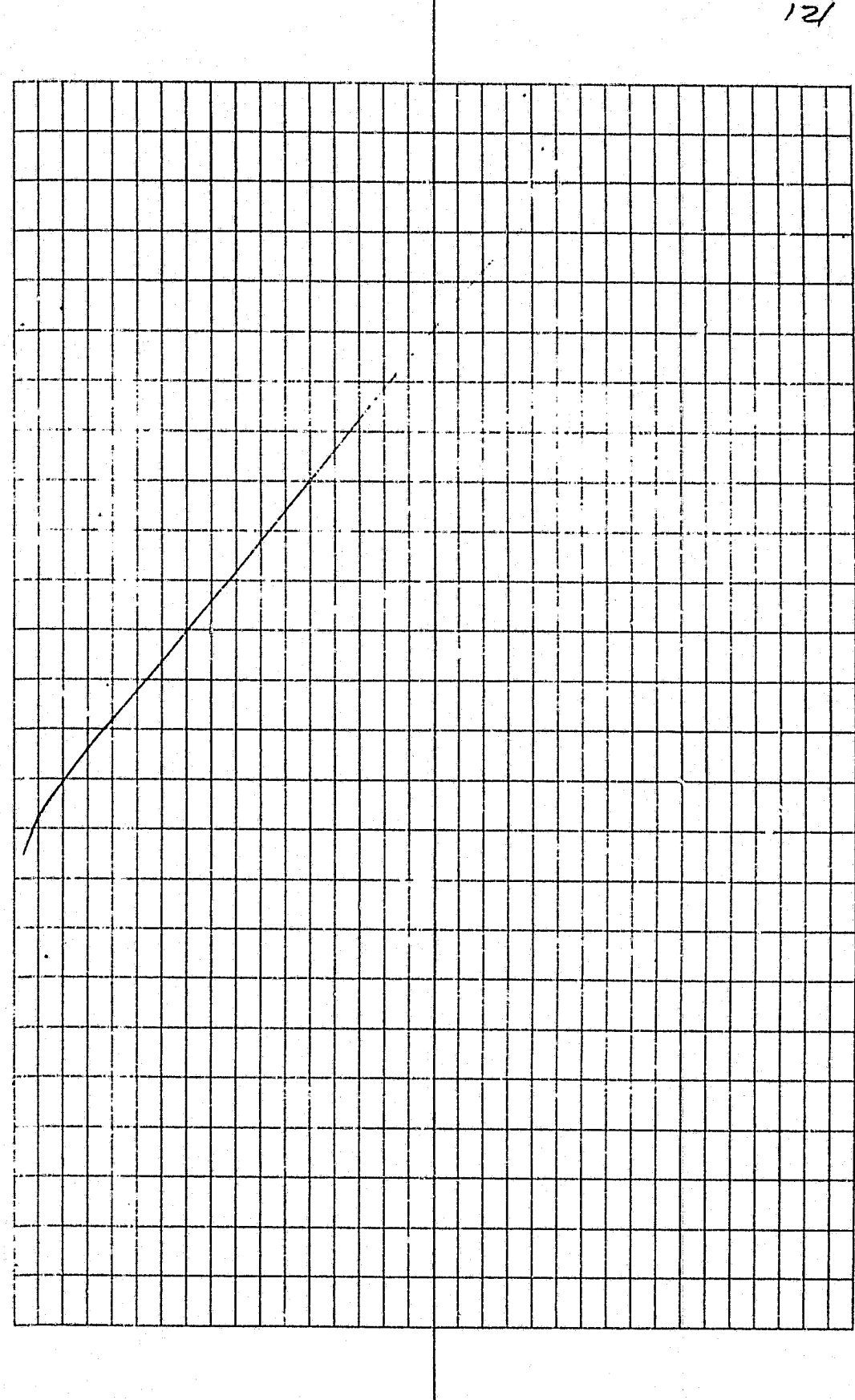
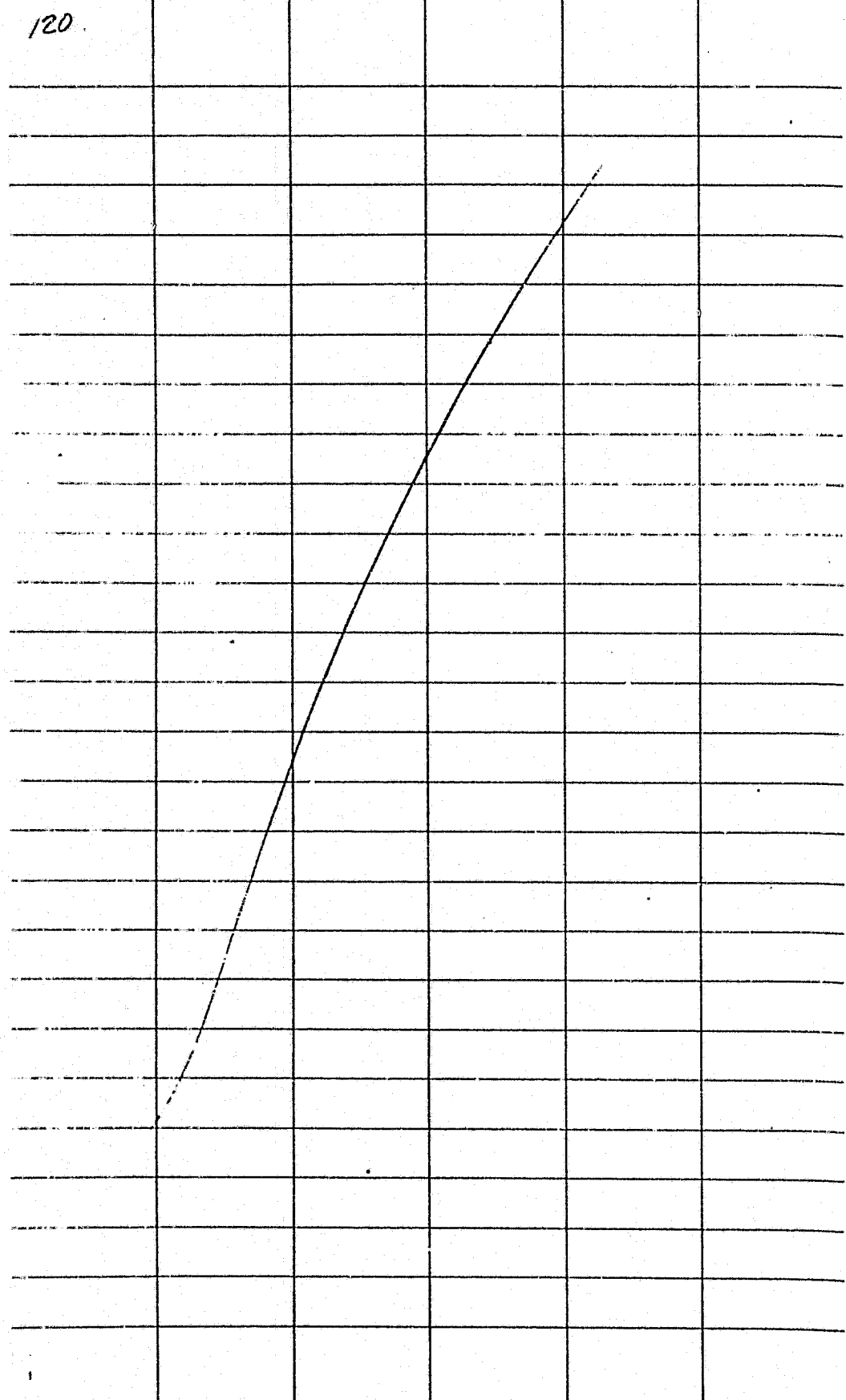
generally 1 to 2 ft but up to
3 ft. All talus is angular
Photo K82-4-20

^{east}
At the end point of S481-5
deposits in the shot hole
consist of 1 ft of vegetation,
over 2 ft of talus over
sandy gravel well graded,
gravel to 3 in, gen. 1 in,
25 to 30% fine to coarse sand, 5 to 10%
fines, yellowish brown.

Southeast of the coffee dam
site (see map) is an
area of slumped talus.
There seems to be a series
of small slides which
make up this feature. They
have a step-like appearance
on the slope. This feature
extends over about 200
ft (length) along the slope
and a vertical distance

of about 25 ft. Talus
exposed at the top of the slump
is 1 to 2 ft in size. The area
is more covered with few
trees.





8/24/82

Plotting of D/S portal
transferred11 AM Take anchors out to
check on borehole
locations AH-M, N+LAH-N ~~is marked~~ AH-M
cleared for brushing
light to medium
scattered spruceAH-M cleared for brushing
light to medium brushing
mostly open with
scattered spruceAH-L cleared
already brushed. Dogs!Anchors will work on
SL82 - L, N+O for the
rest of the day.

- all limits given clearance

WCC shot and completed
5182-E in four
segments. The line is
now called 5182-1

8/25/82 Cloudy

Continue work on 2/5 partial
area data plotting

8/26/82

As above

8/27 Sunny Cool in AM, warm PM

Out with picnic crew
on SL82-D(4)

Shoot 84-4 E end

Shoot 84-4 west end
Battery down ~830

Battery arrives 12:15

finish SL82-B(4) 3:30

4:30

up to SL82-1a(5)
will begin shooting
NE end
completed 5A

9-1-82

Mostly cloudy and foggy. It looks
as if it will be a half way decent
day, clouds are above 6000'. Will
work in the "Fins", upstream portal
area.

Wakana 2240' @ 7° @ ~44°

2286 @ 6°

may 3 ft/hr

W82-146

Moderately to highly weathered/altere
doints. The alteration zone and veins
which cross cut the rock are discontinuous
and localized. Andesite veins have
been intruded into old joints. Because
of the condition of the rock it is difficult
to follow the veins or look at the rock

type in detail. There are a couple of old shears but they pinch out

302° 80° NE, up to 6" of very closely jointed with some breccia. Altered. Pinches out

Estimate 270° 67° S, up to 7", pinches out. Very close jointed

Elev. 1563' @ 83° @ 45°

There are several small fissic veins up to 1" wide, and appear to be discontinuous

This is on the side wall of a small gully which we are walking up.

- on the main chute side of the gully which we walked up.

Altered diorite, silty, small size grains. Soft, friable; brownish-yellow-orange. Some fragments of unaltered diorite within which are slightly-weathered and hard. Zone is a minimum of 18" wide. On the wall side is a 1" grey clay gouge which is moderately plastic. Zone appears

to be approx. 345° and vertical. Forms the gully which we climbed up. Alteration is severely to completely same type of alteration as the shear-alteration zone exposed at river level just below us.

UEZ-167

Small zone parallel to joint face

Elev. 1618'

1616' @ 73° @ 46°

on the west side of the gully. Trend is

320° 80°-85° SW

Shear is 1" to 3". Rock is moderately weathered, hard, very closely spaced jointing

Gouge zone parallel to small shear 3" over to east. Contains vertical lineations and is approx. 6" wide. Material is a yellow-orange, silty-sandy gouge. No visible fracturing/jointing associated with.

Active talus slope ends in the gully

338° 88° SW
300° 85° S

at approx. this elevation. Containing
boulders up to 6' generally less than 1'.

A little higher up on the west side,
the gouge zone is exposed again trending
320°. It is $\approx 6''$ wide. It's a yellow
orange sandy clay, high plasticity

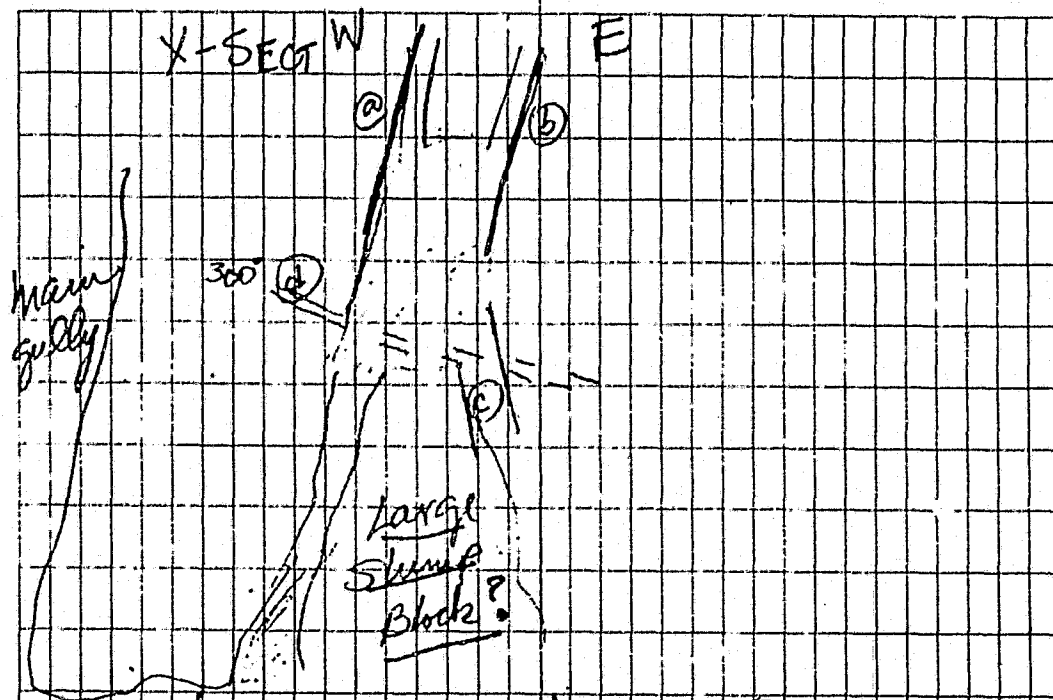
UBZ-168

Small chute which intersects the
main gully. A couple of shears outcrop
here. Large block below appears to have
slumped confusing the correlation of the (c)
shears. Intersection of two shears at

335° 85° NE light yellowish gray
is dry. Moderately to severely weathered
rock, dry. Intersects 300° set which is
orange brown.

- small one on west side (d)

300° 85° SW $\sim 4''$ wide of
breccia & gouge. Gouge is
 $\sim 1''$ thick. The rest is a
breccia. Gouge is a yellow-
orange silty clay.



The rock adjacent to (a) & (b) is rotten
due to weathering. Difficult to tell
how deep the weathering is.

(b) Gouge $\sim 1'$ wide, pale yellow to
mostly yellow orange & orange brown
sandy silt. CO₂ staining on rock
adjacent to
338° 88° SW

(c) Breccia & gouge - estimated thickness
is 8". Gouge is $\sim 2''$ thick, the
rest is breccia. Brownish orange
sandy silt(?). Rough est. on trend
338° west.

1685

ELEV. 1679' @ 11¹⁸ @ 248°

the slickens at @ (b) could be splays on a single shear or two different shears. They connect with (c) and possibly go on beneath the slump blocks (?).

1685

At 1679' in the main quarry in rock is a diorite with diorite breccia within. The rock here is very hard, competent, massive. Diorite is light gray and medium grained. The breccia appears to be everywhere in the rock and it could be a large vein on body of it. Difficult to discern without more rock exposure.

JOINTS:

II 50° 85° NW plane to sl. irregular, smooth, spacing 2" to 5" ave. 2' to 3'

~ 25% are open, up to 1/2"

- primary joint in outcrop is shown in the gully we were in on 8-19-82

- essentially parallel the river.

S

IV 70°

44° (5N) plane, smooth spacing is ~ 5' (2' to 3' on other side of gully)

III 80°

56° N sl. curved, smooth 3' to > 5'

I minor 325°

75° NE plane to irregular, smooth, 2" to 6" w/ 1' of quality, otherwise > 3'

Just above where the gully branches the rock in the east side "changes" to very large blocks ~ 1710' 1615'

These large blocks may be in place. It is difficult to say. One has a 60° joint set but one face is covered with slickensides.

1682 - 1679

Here the main rock face is on the east side of the gully. There are three parallel joint sets with a spacing of 1.5' to 4'. All are 2" to 3" wide. They parallel the rock face.

322°-328° west, - they are irregular.

The gouge is a ⁽¹⁾brownish-orange silty-sand which may parallel a larger hypothesized shear zone in the gully.

The rock face is coated with CO_2 which has precipitated on the outer rock surface. The rock is slightly weathered on the outer surface CO_2 and some FeO staining.

ELEV. 1738' ¹⁷³¹ @ 12³⁰ @ 50°
@ approx 1758, there is a small shear approx 2"-3" wide trending 345°

1082-170

On the north side of the large rock buttress. There is a curved to irregular shear exposed at the base. A pale yellow with some orange-brown
ELEV. 1835' @ 145° @ ~5°
1815

silty clayey sand - gouge
55° 40° SE

Soft & friable. Is a 2' to 3" alteration zone with some shearing associated with. Appears to be a discontinuous, light to medium gray aphanitic rock, like a pod of rock which may have been caught up in the shearing.

JOINTS:

II 60° 38° SE plane to rd curved, smooth; 3' to 4'; ~50% are discontinuous.

I 296° 88° S plane to curved, smooth; 1" to 3'; aver 2' to 3'.

II 40° 85° NW plane, smooth 6" to 3.5', aver. 2' to 3'

Discontinuous fracture zone along the 296° set with a width up to 6". Higher up this changes to an open joint

Approx: 15' higher up in elevation
 the shear/alteration zone is exposed at
 the base of the rock buttress & continues
 upslope, parallel to the slope. The width
 varies from 2" to 1' and contains diorite,
 very fine grained light green-gray felsic
 dike or vein. Has several small shears
 1/2" to 1" apart with up to 1/10" of gangue
 pebbles to gravel size clast of diorite are
 in the dike. The surrounding rock is
 slightly to moderately weathered, medium
 mid- to pale yellow to orange brown sandy
 clay gouge, slightly plastic.

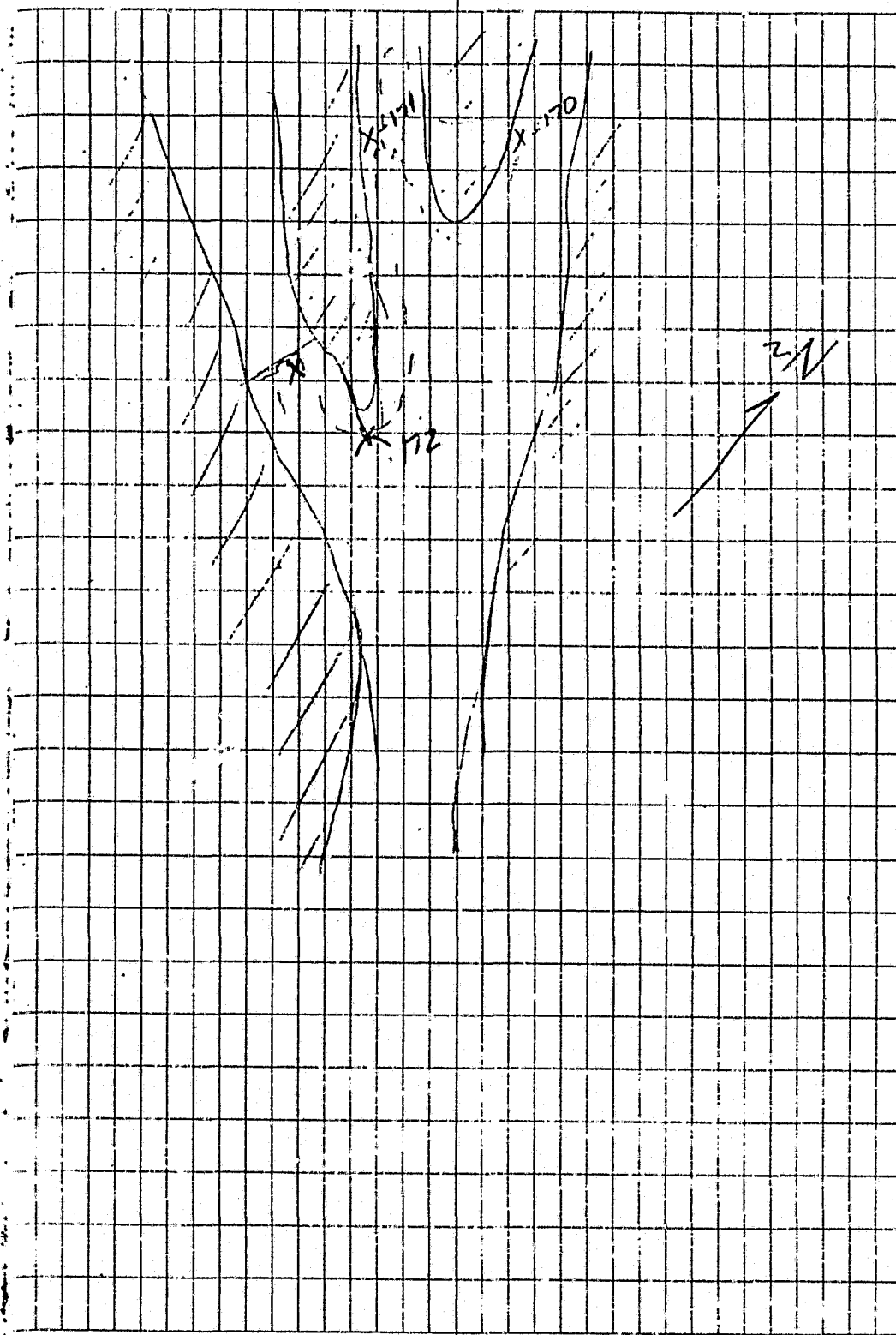
Orientation

60° 60° SE curved &
 irregular

- this location was visited last
 year

W82-171.

Are between two rock buttresses
 in a chute ~ 15' wide with large boulders
 of talus in the chute. The rock on the
 north side at this level is close to
 moderately close jointing. On the south



side is closely to very closely spaced jointing & the rock is slightly to moderately weathered

On the south side is a small shear zone 1' to 2' wide, the shear/gouge is 1/2" to 2" wide, orange brown, sandy clay, moderate plasticity. Jointing on either side is close to very close.

Orientation

308° 85° SW curved

Based on the quality of the rock here & the existence of shear near river level it is speculated that a shear or fracture exists in the trend of this gully 310° vert.

ELEV.

1841' @ 255

1817

@ 1871' there are discontinuous joints oriented 310° Very close to closely spaced jointing up to 15' wide FeO staining

- 3' wide zone was unexposed in the gully. So if there is a shear it is $\leq$ 3' wide

W32-172

A small shear up to 4" wide. No major fracturing or jointing associated with Breccia & gouge compose the shear. There is up to 2" of a - pale yellow & medium brown clay gouge; high plasticity. The

1611 1695' @ 303

sect is the yellow orange to orangish brown breccia, silty-sand

Orientation:

307° 80° NE

The rock is a light gray, medium grained sandstone

- approx 5' higher in elevation in the adjacent gully. Rock outcrops across the entire gully. Have walked up here before.

JOINTS:

J1 T8° 60° NW-NW plane to curve, smooth; 2" to 3' over. @ 1' to 2'

II 25° 48° SE plane to sl curved,
smooth; 2" to 2'; aver. 1'
I 315° 75° NE plane, smooth
6" to 5'; aver. 4' to 5'

W 82-173

Small gully which trends 340°. At the narrowest point in the gully, a shear could be a maximum of 3' wide and it would have to bend around in here. Some gneiss and quite a bit of severely altered diorite is exposed. To meanders through the rock outcrops in this ridge. At the center of the ridge it would have to be oriented 355°.

The pale yellow to yellow orange gouge is up to 2" to 3" wide. Silty to clayey sand. Dry.

The altered rock is soft & friable.

ELEV.

1650' @ 3° 35'

1604

W 82-174

Small irregularly parallel or sub-parallel to the one @ 82-173, Small shear ~ 2" wide. Yellow orange, sandy-clay gouge, moderate plasticity. Adjacent to this on the SW side the rock is severely altered, soft and friable, with a minimum width of 6'. Talus blocks fill the chute. The gully is oriented 340°

ELEV.

1633' @ 4° 12'

1605

JOINTS:

II 76° 73° S plane & smooth
3' to 4'

III 340° 78° SW sl. curved,
smooth, face of outcrop

IV 280° 35° S sl. irregular,
smooth to sl. rough
2" to 1", only in
upper part of outcrop,
discontinuous

- open joint 10' down slope

80° 85° N to 85° S

open to 3"

- approx 15' down from the last gully is a 2' wide gully oriented 355° . Tried looking for shear/gouge but due to soil cover, could not encounter. It is likely that a shear trends through here.

On the rock on the east side there is a great deal of Carbonate on the rock face. In addition several joints are filled w/ CO_3 Dike crosscuts. Is a light gray, fine grained granitic dike. Maximum width

Triangulate to:

to MAC 138°
 $\frac{130}{218}$

to Knob 106°
 $\frac{130}{236}$

is 1.5'. Oriented 355° 75° E
 Contacts are sharp. Dike is more fractured than the surrounding rock.
 CO_2 filling along some of the fractures.

Rock is very hard, quartz content of $\approx 25\%$, $\pm 5\%$ mafics. FeO staining
 Open joint up to 4", parallel to the one above, 80° . Spacing of 20'-25'

W82-175

Another gully on the NE side of the main gully. A large shear, gouge zone approx 3' wide is exposed. It is a pale yellow to yellow orange color
 Trending 2° $\approx$ vert

ELEV.

1589' @ 5° @ 54°
 1559

- Large talus blocks are in the gully at this point up to 12' across

Crossed over to the next major gully upstream. Narrows to 6' across

W52-116

An aphanitic, light gray felsic dike approx. 4" wide is intersected by a shear/alteration zone approx. 4" wide. Severely altered diorite, soft & friable. Light yellowish gray to a yellow orange. Gneiss is a sandy clay, moderate plasticity. Sand comprises 20-30% sand. Width is 2" to 3". Orange brown. Oriented 305° west. Goes up gully.

Felsic like crosscutting alteration zone but truncates the shear. Fine to medium grained, 20-30% quartz. The rest is feldspar. Fresh to slightly weathered, hard, very close fracturing.

Closely spaced jointing on either side of gully. Slightly to moderately weathered & altered.

ELEV. 1600' @ 5²⁵
1:61

Watana

2296' @ 6²⁸

9-2-82

It's cloudy and overcast with a ceiling at ~6000'. Will work in the "Fingabuster" area, downstream portal. SNT & DWL will also be going with us.

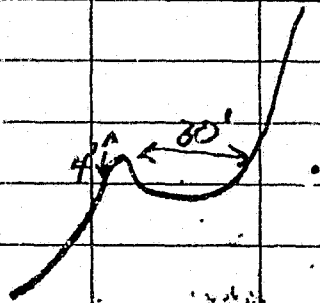
Watana 2260' @ 6⁵³ @ 39°
2260' @ 12³⁰ @ 54°

PM K White & S. Ashland
to Fingabuster

From BH-2 proceeding
east toward portal mapping
area

In slump block area
E1 1956 @ 1²⁰ PM

ridges running parallel
to slope 4ft high and 75ft
long appear to be top
of slump ~~area~~
Oriented 285°



In main gully, labelling and
tracing shown.

Shear DP.1 (see map).

traced along base of
three bedrock exposures.
no exposure of sheared
material. trend lost
in talus slope. Intersects

West end of SL82-H

Shear DP.2 (Flagged, see map)
major left lateral zone
cannot be traced beyond
gully. May split into two
segments. The first can be
traced across the gully
about 20-30 ft east.
A second branch may
crosscut gully at
a bedrock step about
10ft below the upper shear
no evidence for this
except bedrock step.

Where shear passes out of
gully on east side the
slope is talus covered
with angular blocks
about 6-10 in. in diameter.
No attempt to trace shear
to the west.

discrepancy

Working down the gully
to Shear DP-3
Shear DP-3. Traced across
gully to east across top
slope and above small outcrop
see map.

Approximately 8 ft down from
Shear DP-3 is another apparent
shear. The shear is exposed
in the gully wall where
it trends $270^\circ/75$ North.

The upper three feet of the
shear is 6 to 8 inches of breccia
and gouge. The zone is
intercalated by a joint plane
($310/50$ SW) below which
there is no shearing only

149
in joint. Above the joint
plane the rock is FOLX
stained with open joints and
a loose appearance. Below
the plane the rock is
somewhat fresher with
few open joints.

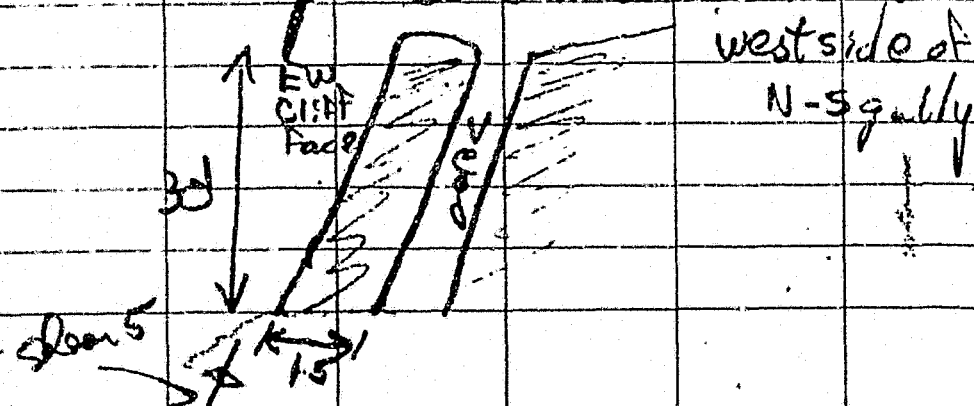
Upon excavating this shear
and plane, there is no
offset by the joint surface.
The shear simply terminates
into a joint. Another explanation
could be that the apparently
sheared material is actually
disintegrated that is also weathered
giving a shear-like appearance.

Shear DP-4 See map.
Exposed in main gully
traced eastward, assuming
that shear lies in top low
downhill from bedrock
outcrops.

Shear DP-5 (see map) -
 followed joint face
 which is uphill of the shear
 to the east. Follows along
 cliff base. Went only
 as far as N-S gully marked on
 map.

Climbed up gully and
 found shear on east side.
 Shear trends 303/85 S
 and is approximately
 3 to 4 feet wide. Composed
 of silty/clayey sand
 breccia, yellow orange,
 soft, friable.

Shear projects to west
 side of gully where it
 joins up another gully
 parallel to its trend.



See Drawing.

Large block between shear
 and cliff face which may
 have slumped.

Followed shear westward
 to gully where it
 probably aligns with
 shear near survey point
 X (see map).

Continued westward onto
 slump block into 2nd
 gully.

Attended shear zone
 about 1 ft wide.

295/80 S
 EL 1570 at 5:55 PM

DP

WW-3

EL 1410 6:10 PM

End of Track 20

AAI BOOK 21

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STA NUMBERS:

W 82 - 180 through 223

201-207 Duplicate

BOOK #21

①

9-2-82

Afternoon, working on getting
bulk samples from Deadman
Creek.

W82-2

Bulk Sample from UNIT G
PIT # 5, 6, 7, 8 all at approx the
same elevation. See sketch in
Book #18 page 51, description on
page 50.

It's a basal till which is
overconsolidated. Cobbles up to 12"

Estimate ~ 20% gravel to cobbles

Could this be the new till unit &
not G. We don't find it laminated
anyplace. It would fit the mapping
data better.

max cobbles size ~ 2 1/2 - 3"

% > 3" avg. ~ 15%

Bulk sample at Pit #3, 3a, 3b. Material is a gravelly, silty sand. Moderately dense, moist.

Gravel to cobbles comprises 20-40%, over 25% of the texture, the unit resembles

UNIT a slightly compact sandy till.

Max size gravel in pits is 10".

E/F If the gray brown basal till below is the new till unit, then this is an ablation till at the top otherwise it is unit E/F

Cobbles to boulders on the surface are 2.5'. Some are polished and/or striated

Max particle size ~3 1/2"
3" max ~30-35%

UNIT C

Sandy till

No

Gray sand till

D, D,

E/F

G Laminar w/ isolated patches of waterlain till

H

I

J, J,

K

Bulk Sample at Pit 1, 1a, 1b. It is definitely Unit C, a gray (?) gravelly sand.

Max particle size ~2"
% > 3" ~25%

General agreement that our interpretation on the surficial mapping is correct to date on units C, E/F, G. Those in agreement TFD, RAW, DWL, SNT.

9-3-82

It's cloudy, raining lightly.
Will do a traverse from centerline
to the FNS on the north abutment

Watawa

2260' @ 75° ~ 40°

UP-4 1527' @ 72° @ ~ 45°?

UP-4 = A

A to B 98' 243° 2° UP 9.8

B to C 97' 235° 2° UP 9.7

C to D 48' 309° 21° UP 11.5

- base of outcrop

D to E 20' 246° 19° UP 1.1

- center of gully in the outcrop

- skipped a few STA #15

WBZ-180

This gully continues uphill with bedrock exposures on both sides & intersects SL82-KC just 30' east of P-34. If there is a shear here it is no wider than 3'. We do find the orange brown sandy silt (possibly silt) mixed in with rock fragments/talus. It is wash and not in place. Fracture zones parallel & cross cut the gully. These fracture zones are characterized by very close to closely spaced jointing.

The probably shear zone here would have a maximum width of 15'.

JOINTS:

fracturing along the joint } I 307° 75° NE, face of outcrop, subparallel to gully. Plane, smooth to rough 2" to 1' where visible

II 30° 78° NW plane to sh. curved, smooth

- 50% are discontinuous;
1' to 2'; aver. 1' to 2'

IV 345° 30° NE-E; plane to
sl. curved, smooth; 1" to 3"
aver. 2"

- spacing widens with depth
in outcrop face.

fracturing
this set
done } IV 75° 8° N plane to sl. curved,
smooth, spacing 2' to 3'
- approx. 25% are dis-
continuous

Rock is a light gray to light
greenish gray schist. Slightly
weathered, CO₂ & some FeO
staining. There are several small
felsic veins & dikes - light yellow
gray fine to coarse grained.
Quartz ≈ 25% ± 10% mafic

Strike of dikes:

322 85° SE, 4" wide
apparent
offset 4" to NE

The dikes & veins are offset along
the 75° set.

Offsets appear to be old, when plane
is tight & not continuous

Half way between SL 82° & E
"zone" 8' wide trending 35° 82° SE,
open joints with a 6" to 1' spacing. Some
blocks are loose

Approx 40' above STA E, is a
step in bedrock in the ridges bounding
this gully along the 35° set

The trend of the bottom part of the
gully is 310°-315°. Talus fills the
gully, vegetation covered.

ELEV. @ D

1571' @ 845 @ 15°

D to F 91' 228° 5° UP

- bedrock is exposed off on across
here & where it is not it appears
that it is close to the surface

F to G 55' 253° 10° UP

@ 14' the outcrop exposure turns
 & trends up slope subparallel
 to this segment on the N-NE
 side.

- flagged tree here, will come
 back to do the gully

ELEV. 1585' @ 90°

G to H 72' 73' 200° 9° dn

- on talus slope which is ~80%
 moss covered, boulders up
 to 4' generally < 2.5'

H to I 17' 49' 242° 7° UP

- end of talus slope, outcrop
 begins at this elevation

I to J 60' 232° horiz

- outcrop ends at 45'

W82-181 (I to J)

Outcrop along this base line
 with closely spaced jointing throughout.

Is a shear which pinches out (?) 2' higher
 in the outcrop. There is continuous outcrop
 @ 40' 337° 85° SW

exposed across the top of the shear
 with no visible trace for continuity.

Shear zone is a maximum of 1.5' wide
 with a yellow orange to orange brown
 breccia gouge. The rock is moderately
 weathered on either side. Gouge is
 a sandy clay, moderately plasticity
 up to 1" wide.

Open joints generally < 1/10"

JOINTS: @ 20'-35'

I 310° 72° NE plane, smooth
 2" to 1.5'; aver. 6" to 1"

~50% are part open to open

II 35° 85° SE plane, smooth
 2" to 1"; aver. 6"

~75% are open

IV 85° 27° N plane, smooth
 6" to 3'; aver. 2' to 3'

minors III 345° 78° W plane, smooth
local set, $\pm 10\%$ of outcrop
spacing 1'.

Outcrop is the beginning of a ridge
on the side of the gully which trends
up slope.

J to K. 5' 72' 171° 41° dn

crossing vegetation covered
talus slope subparallel to
downstream ridge of crest
of the gully. Nose of outcrop
end at 67' & outcrop
continues across slope in a
downstream direction

ELEV: (K)

1540' @ 10²⁰

Rock is a brownish-gray diorite.
20% 30% mafics, medium grained.

Fresh, very hard to hard. Quartz
 $< 5\%$. Mafics are biotite & hornblende

87 131a

JOINTS:

II 60° 77° N plane to curve
smooth face of outcrop

8" to 11"

I 305° - vert plane to sl irregular
smooth; 1" to > 5', present
locally but not through out
the outcrop ($\sim 10\%$)

IV 90° 20° N plane, smooth
2" to 2' over 1' to 1.5'

- outcrop is 8' high, then
vert is only visible over the
lower 10'

20° vert to 80° SE curved,
rough, forms part of face of
outcrop, possibly discontinuous.

K to L 62' 245° 6'-7' up
- continuous outcrop across here

② 29' Fracture zone
 325° 60°-72° NE, 1-2' wide
 very closely spaced joints
 Most joints are part open
 may be discontinuous
 outcrop continues 40' to 50'
 higher, some loose blocks

③ 51' Felsic like - very highly
 fractured. Light white grain,
 fine grained, 20-30% quartz
 mafics ~ 50% (?). Felsic to
 slightly weathered, hard,
 highly fractured, very closely
 spaced fractures
 340° west
 Contact is ~ 10° to 15°
 the rest are part open
 Average width 1'
 12' Outcrop even at
 joint face 88° west

L to M 21' 225° Horiz

outcrop continues up slope along
 the 88° face. Gully between
 L & M trending ~ 88°

↑ 293°

- jointing is very close to closely
 spaced jointing; 1" to 6"
 Gully is a result of inter-
 cting joints

20° 8° E

293° 55° N

the 20° set may be due
 to weathering, stress relief
 Difficult to determine trend
 to of fracture zone

290° 8°

10° 15°-15'

- no shearing was found

54
 M to N 55' 245° 11° UP

- continuous outcrop across
 ~ 20' high

@ 10' Rock is characterized by close to very close jointing, CO_2 staining

Joints:

II 73° 68° N plane, rough, CO_2 staining, 3" to 1' interval, 3" to 6"

- face of outcrop

- possible that there

a fracture zone parallel to this set on the downslope side.

III 330° 85° NE plane to sh. irregular, smooth, 2" to 1', generally 6" CO_2 staining

0.0' - 18.0' very close to closely spaced jointing. Joints are tight & rock is massive.

18.0' - spacing is 4" to 1.5'

@ 35'

25° 80° SE plane, smooth; 8" to 2', interval 1'

@ 41" is a notch in the rock face which is due to the intersection of the 25° & 300° joint sets

- possible shear (?)

330° 85° N - vert. zone

1' wide of moderately weathered & medium hard diorite. If there was one it would be minor.

N to O 23° 32° 115° 43° down - outcrop dip from 0.0' to 26.0', N is on top, O is at the bottom

1546' @ 115° @ 45°

O to P 100' 243° hori.
 @ 10.0' - 24.0' is a gully, centered
 at 17.0'. For the rest of
 the segment the rock outcrop
 is continuous.

182-182 (O to P)

Rock is the light gray, medium
 grained diorite. Hard to very hard,
 slightly weathered. Most of the rock
 is stained, difficult to get in unstained
 piece.

No shear was visible up in the
 gully. Believe it is the intersection
 of two joint sets:

290° 80° S

80° 88° W

2.5' wide { @ 24' on West side of gully, diorite
 White-gray, fine grained, felsic
 dike. 20-30% quartz, ~5%
 M. f. i. c. Fresh ^{very} hard. Open
 joints/contact on both sides, 1/10"-1"
 285° 66° N

Three feet up slope is another one

which parallels. It is a Maximum 5'
 wide in pinches out.

A small vein on the N. side of the
 80° " wide

The main dike is no more fractured
 than the rest of the rock.

— @ 42' to 46' Old shear, heavy
 60% staining. It is now healed
 & the rock is hard. The shear
 is curved & averages 1' wide. Most
 joints terminate at it. Oriented
 340° 80° W

Felsic dike ^{hy. shear} crosscuts ^{hy. shear} is a
 minimum 8" wide

60° 80° NW

Contact is fractured but tight.

— @ 68' Felsic dike, tight, sharp
 contacts, 2' wide
 0° 85° E to 85° W

- can't see it 10' above, it may
 narrow or pinch out.

The felsic dike is light gray, fine to medium grained, + 2% mafics, 20-30% quartz.

JOINTS:

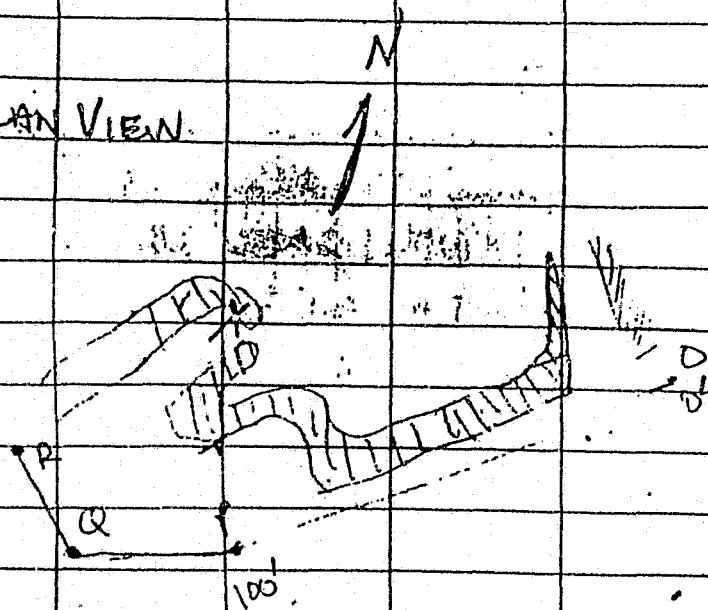
IV 0° 85° E plane to sl. curved, smooth, 1" to 3', aver. 1'

I 295° 85° N plane, sl. rough - face of outcrop; 1" to 2'

II 90° 32° S plane, smooth 1' to 3'; discontinuous

III 340° 80° NE plane, smooth aver. 1', 50% are discontinuous

PLAN VIEW



1270

JOINTS @ X

II 35°

well developed

76° NW sl. curved, smooth, 1" to 3', aver. 1' of gully; 1" to 2' fracture zone, 1" wide, 1" spacing. Otherwise 4" to 2', aver. 6" to 11'

I 310°

80° NE plane, rough 2' to 4' - head of gully

II 278°

45° S plane, smooth to sl. rough 1' to 5' - gully appears to be a function of jointing.

II 95°

sl. shear which is healed. Width is 6" to 1/2" fracture zone. Tight, hard.

I to Q

40°

266°

6° UP

Q to R 33' 316° 24° NP
 - at base of rock cliff again
 15'-22" high

JOINTS

IV ✓ 220° 18° N plane smooth
 1" to > 5', area 15'
 - a zone 3' to 10" wide
 very closely spaced,
 discontinuous;

- not in upper part of outcrop
 I ✓ 310° 80° NE. curved to NW
 curved, smooth
 2" to 2'; area 15'

— Possible thrust fault along
 the ~~220° 18° N~~ JOINTS above &
 below do not match up. Approx
 away upstream is old shear
 zone with an orientation of 18° N.
 They may line up if we are on
 irregular surface. It is a small
 bedrock fault, no large-scale
 movement.

JOINTS (cont.)

10° west plane smooth
 1/2" to 6" N. to S. 1" to 2"
 - these joints are in the
 upper part of the outcrop
 of the rock cliff

R to S 100' 250° long

@ 20' to 40' these open joints
 273° 80° N to west open
 joint up to 1"
 2 @ 20'
 1 @ 40'

- just near the top joints
 "become tight" further in

@ 50' to 62'

For 8' along outcrop of shear
 zone, heavily faulted, discontinuous
 face of outcrop to 290° 70° N
 the fractures in the shear zone are
 tight

345° 58° NE plane, smooth
 CO₂ filled = lining 2" to 4"
 10° 85° E to 85° W curved
 6" to 1'

- doesn't occur in fracture

- gap

width is 2', joints outside
 shear zone, spacing is
 wider

5 to 54' 2.11° 13° up

@ 24' Open joint, 2"

315° vert.

filled with angular rock
 fragments, soil

35'-40'

POINTS:

II 30° 72° NW plane, smooth
 spacing 6 to 2', most
 are open to 1/4". Elsewhere
 moving down slope

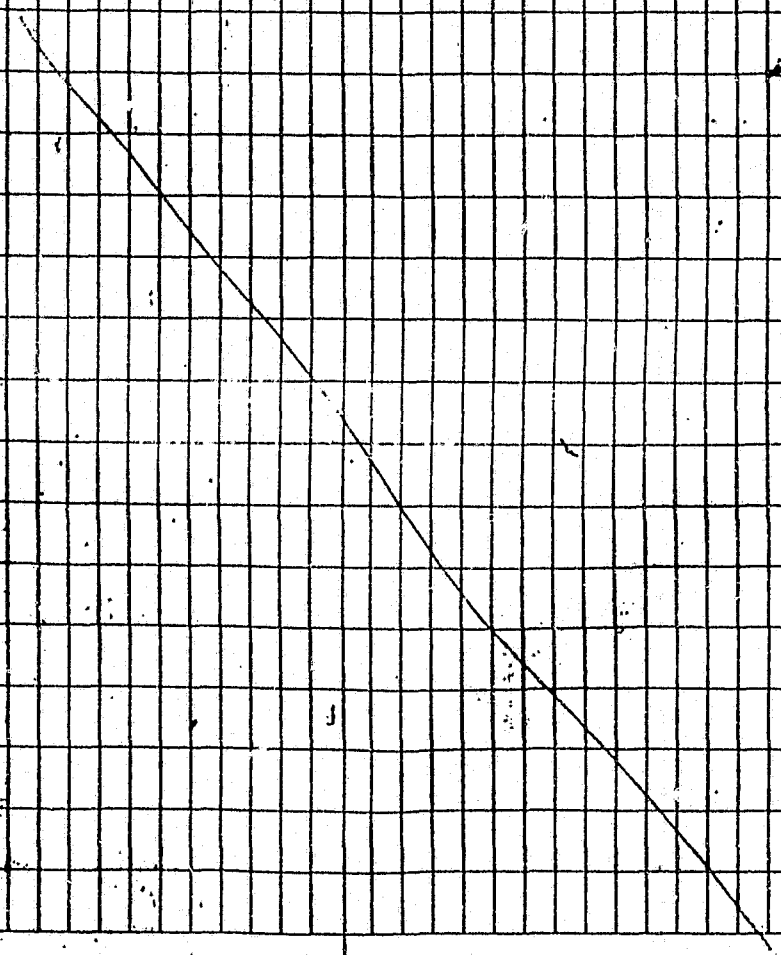
I 108° vert. plane, smooth

1' to 2'

IV 265° 47° N curved plane
 2' to 3'

I EAEI.

1595' @ 3.52



T to U 73' 245° horiz
crossed a gully, vegetation
covers 20% of the talus

U to V 47' 243° 20' dr
- talus slope continues across.
Chert from above ends at
250'

- 250' - continuous
rock outcrop. Rock is still
the light gray, medium
grained diorite
Very prominent faced outcrop
along a curved joint. Blocks
are spalling from the outcrop
face along the joint.
050° / 50° NW

Q 26' open joint, open 1"
310° / 85° SW

- is within a narrow fracture
zone which is an additional
6" wide w/ very close
jointing

@ 29' open joint; open 4"
 295° / 70° N
 - some soil & rock fragments
 within

JOINTS

IV 030° / 50° NW curved, smooth
 1' to 15', over 6" to 1"

II 045° / 88° SE plane to top
 irregular 10" to 3'

II 014° / 73° W plane, smooth
 6" to 1'

II 065° / 49° SE; irregular
 rough 2 to 3'

V to W 34° 237° horiz

@ 50' the outcrop ends
 another major talus slope
 from above begins. Only
 10-15% of the area is
 - vegetation on trees covering
 - the blocks & boulders up
 to 8' o. Steep slope

W to X 78° 255° horiz
 - talus continues across the source
 for which is 20' higher in
 elevation & parallels the traverse
 K to W was here last year.
 active spalling

X to Y 45' 273° 15° horiz

- talus continues. Rock
 outcrop ends above, talus
 is coming down slope from
 higher up, continues down
 stream in 10-20 slope

Y to Z 5' 70" 183° 43' du
 - going down the talus slope
 following above flagging

Z to AA 71' 50' 218° 28° du
 - talus slope is mostly covered
 by vegetation from here
 down to the river
 - have intersectal SL 80-3
 Will follow to the river.

Take centerline across stream
in the downstream direction

26

AA-BB 34.5' 176° 4' du

BB = T&M survey point

WEX 106' BB

ELEV. 1501 @ 550

63

BB-CC 62.5' 177° 22' du

CC is end of SL80-3

Wakana 2285 @ 550

9-4-82

It's foggy this morning, looks
like it will burn off. Will do a
traverse at river level from SL80-3 to
major outcrop at river level just downstream.
Then will traverse up the gullies of
GFZ

Wakana

2260' @ 700 @ 39°

Will start the river traverse from the
bedrock outcrop at river level below the
east end point of SL82-Ka.

A-B 67' 74' 025° 26° UP

A is at river level, adjacent to
bedrock

Plotted from point
"V" (known
location)
back to "A"
- line parallels the rock face, 45°
80° E
@ ~ 50' outcrop exposure
turns upslope

- @ B, outcrop is ~20' across slope
- walked on talus all the way up, is on the ups side of the line.
- walked upslope at ~30° and later on a 280° azimuth at least 100'+, parallel to bedrock on talus slope. No shear is visible anywhere

B to C 27
32 78° 31° dn
- on talus slope ~90% covered by vegetation

✓ C to D 41
42 39° 11° up
- crossing the talus slope at edge of bedrock on the ups side of the gully

D to E 34
40' 101° 31° dn
- line parallel rock exposure talus to the downslope side

4) 82-183 (D to E)

Rock outcrop 15' to 25' partly covered by vegetation. Some slumping of blocks on the outcrop has occurred. Greenish gray, medium grained diorite. Hard, slightly weathered, many loose blocks at surface. Joint measurements @ 400' are approximate due to the looseness of the outcrop.

JOINTS

@ 9.0' { 1305° 80° SW trend of gully (or close), face of outcrop
15° 80° E plane, smooth

@ 40.0' - 11.0' ME to F { 52° 80° SE - vert.; plane smooth; face of the outcrop
60° 6" to 1', open - 1/4" 57° S plane, sl. curved, smooth; 3 to 4', open < 1/4"

330° vert. plane to sl. curved, smooth; 6" to 2', aver. 1"

85° 11° N plane, sl. rough, discontinuous (?); 1' to 5' aver. 2'

- ✓ E to F 56' 45° 12° UP
- @ 25.0' to 56.0' gully which trends 305°, in talus covered by vegetation
 - outcrop is continuous from 0.0' to 25.0'
 - @ 56.0' apex in rock outcrop. upstream it trends ~ 80° for a few feet before cutting upslope
 - @ 305° up 40' in elevation from F
 - there is some red staining on the rock as observed in the core. Sometimes it follows joints / fractures.

JOINTS:

- 195° 84° N plane, smooth 4" to 3', 1' to 2' aver.
- 325° vert; lower face of gully; plane to sh. curved smooth, spacing 1' to 2'
- 40° 78° NW plane, smooth 6" to 2'; aver. 1'
- minor 0° 65° E plane, smooth locally, 6" to 1', discontinuous

Following the gully upslope find a zone of active talus, the rest of the gully talus is vegetated over. The active spalling is occurring in a portion of the outcrop where jointing is close. As a result, massive outcrop is exposed. Ridge on SW side of gully is entirely loose.

- F to G 56.0' 74° 13° UP
- @ 24' outcrop trends upslope at 35°

W 82 - 184 (F to 24.0' upslope at both ends)

Light greenish gray, fine to medium grained, quartz diorite. Quartz ± 10-15%. Plagioclase ± 20-30%, biotite ± possibly hornblende. Plagioclase phenocrysts (green) coarse grained, 5-10%. Fresh, very hard, massive competent. ↓

The ridge between the gullies at F & G is massive & very sound rock.

JOINTS: @ 24 to 30'

280° 80° N plane to sl curved
smooth; 4" to 2', aver. 1'-2'

35° 85° SE to rest plane
smooth, upstream face of
outcrop; 6" to 1'

85° 20° N plane, smooth to
slightly rough; 1' to 3'
discontinuous (?)

✓ G to H 77' 100' 69° 7° dn
- crossing a gully which
has vegetation covering the
talus blocks.

✓ H to I 46' 47' 37° 12° up
- @ 37' rock outcrop exposed
major cliff face starts @
47'

W 82-185 (I)

Joint

4844 / 85 SE

plane, smooth to sl rough
CO₂ staining, part open
spacing 2 in to 1 ft, av 6-12 in

✓ 487 / 82 N

planar, smooth, face of outcrop
spacing 6 in to 3 ft

✓ 305-312 / 25 to 34 NE

planar, smooth
spacing 1 in to 18 in, av 12 in

✓ 310 / 85 SW

planar, sl rough to rough
sp 6 in to 2 ft, av 1 ft
CO₂ coating, part open

over

Joint (cont.)

Minor

280 / 22-27 S

plane, smooth
sp greater than 3ft

10

✓ I to J 46' 53° 30° UP

- line parallels the rock ridge.
Rock is continuous; massive
and competent.

- @ 20' - open joints, blocks on the
downslope side may have slumped
- ~~3' wide~~ 3' wide, blocks from
adjacent rock has slumped

295° 85° S

into. Possible shear 1"
wide. On the downslope
side 1' there is no exposure

@ 31.0' Large open joint, up to 1"

303° 70° NE

- joint is ~ 20' high

37

✓ J to K 33' 58° 13° UP

- rock is continuously exposed along line.

✓ @ 16' Large joint face on
outcrop exposure 85° vert.

At this azimuth there is a
gap in the bedrock exposure
of 8' from here to downslope,
approx pt. J. No indications
from rock cliff if a shear or
fracture zone trends through here

@ 19' opening approx 1'
wide, oriented

310° 65° NE

Rock is exposed across the
opening farther in. The
rock there is very closely
fractured. It's either slumping
of the blocks to the SW or
a small fracture zone

Joints @ 20' - 26'

40° 85° NW to 85° SE face of
outcrop, plane, smooth,
1" to 6".

270° vertical plane, smooth
2" to 1'

- seen from 16' to 30' on
line

330° 63° N plane, smooth
spacing > 10', probably

- outcrop is massive, joint spacing
wide in any one set. Will not
get a representative sampling
here.

✓ K to L 32' 96° horiz.

- outcrop ends at ~ 11.0' and a
gully begins. It trends 14°
the east side of the gully is
at L

@ 10.0' and 25' higher in
elevation there is a fracture
zone with minor shearing

292° 85° S

It is 1' wide, very closely
spaced joints. On the north
side is 1" of breccia

- up in the gully ~ 40' higher than
the line, if a shear is true, a
zone trended in such a way, the maximum
width it could be is 10', & it is
probably less. It would have to
trend between 20° to 30°

- gully is filled w/ talus, which is
completely covered by vegetation

✓ L to M 90° 149° 39° dn

- line parallels bedrock all
the way down to M where it
ends.

- rock exposure is continuous

✓ M to N 22' 25' 81° 29° UP

- bedrock ends at 7.0'

✓ N to O 46' 25° 15° UP

O to O' 55' 279° 20° UP

- nearly intersects line L to M

W-82-186 (O'-P)

Large rock cliff exposed along the entire length. Rock is the light greenish-gray fine to medium grained diorite.

@ 34.0' small gully which resulted from the intersection of joint sets.

@ 20'-25'; Folitic like, light whitish gray, very fine grained to aphanitic. Quartz ~ 10-20%. Fresh, hard, highly fractured - very closely spaced.
Estimate orientation

75°	West.	(85°) ?
-----	-------	---------

Fragments of dice up to 4" which are in the diorite

Estimate 4' across max

at 0.0'	Fractured rock	6" to 1'
---------	----------------	----------

may have been caused by sleeping

Heavy CO_2

$$V_0 \rightarrow P$$

56'

85°

1000

- rock is continuously exposed across this. Massive, competent

POINTS @ 45-53'

10°

1800	2
------	---

plane

plane, smooth

6" to 1.5'; aver. 1'.

268°

81° N

121

plane, smooth

1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90	91	92	93	94	95	96	97	98	99	100
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face of outcrop

11 to 6
fracture zone
@ 4/2 d

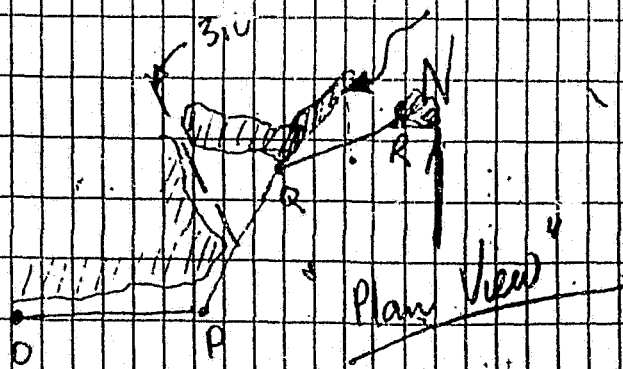
P	to	Q
---	----	---

68'

320

 27° N

- not very good rock exposure across



slope from Q

- ② 17.0' Possible fracture zone along 45° set
 ↑
 m Q to R
- ✓ 45° 85° SE to 85° NW plane,
 smooth,
 - face of outcrop
- ✓ 335° 85° SW plane of smooth
 2" to 1' over 6", most
 are open to 1/4"
- ✓ 280° 22° N plane, smooth
 4" to 1.5' over 1"

Fracture zone has a maximum
 width of 30' if it exists

- ✓ Q to R 43,
 46 59° 20° UP
 - at 41' to beyond R is a small
 outcrop
- ✓ R to S 26
 28' 121° 24° du
 - rock outcrop below S

- ✓ S to T 48' 57° 49° UP
 @ 15.0 - 29.0' rock outcrop
 @ 36.0' - 48.0' rock outcrop approx
 10' higher in elevation.
 - neither of these exposures are
 parallel to our line, but are
 subparallel to the contours

- ✓ T to U 34' 74° 12° UP
 talus blocks are visible through
 the vegetation mat, are ~ 75%
 covered
 - ~~5' higher is directly above this
 point is bedrock~~

- ✓ U to V 49
 50' 82° 10° du
 @ 44' the talus slope from
 above begins. There is talus
 along the entire line but
 from 0.0' to 44.0' it is from
 the outcrop just above
 @ 14.0' - 50.0' there is a rock
 outcrop, approx 5' higher

in elevation & subparallel
to the line.

1629' @ 152

@ 16'; Light whitish gray felsic dikes,
aphanitic. Estimate the orient-
ation as:

70° 65° NW

Is more fractured than the
surrounding rock, but not as
bad as seen earlier

2" to 4"

- west edge of ridge trends

305° 70° N

- trend of gully is 345°

JOINTS:

305° 70° N 6" to 5'
aver. 2'

15° 85° E plane, smooth
3" to 2'; aver. 1'; open
- spacing width increases up to 1"
to the east

50
✓ V to W 57' 135° 29° dm
- on talus slope, moss cover
somewhat on boulders & in gaps
between. Boulders up to 4'

80
✓ W to X 97' 97° 22° dm
- cut across talus slope, more
vegetation on & between boulders
towards east. On SL80-3
X = MRX 106 RB 1981

102
✓ X to Y 68' 183° 24° dm
Y = end of SL80-3 1980
1541' @ 2'±

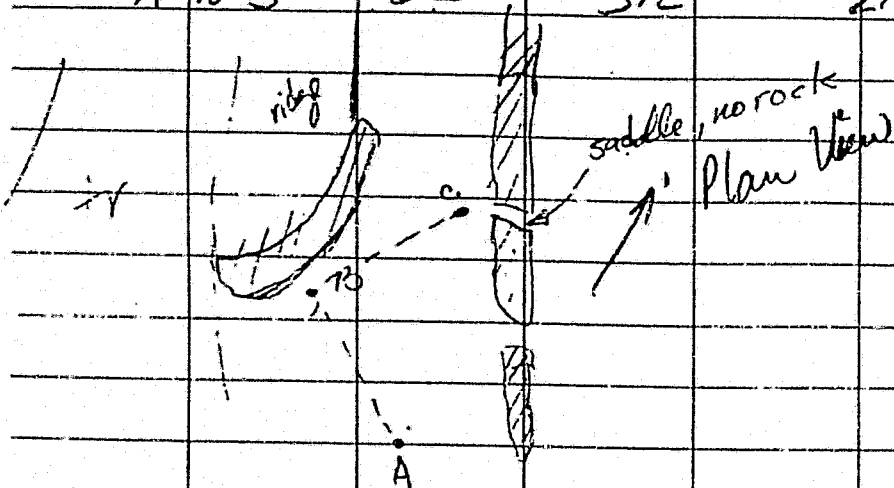
Found many more outcrops along this
traverse than was anticipated. As a consequence
there are very few gullies where shear/fracture
zones can cross cut the area. In general
rock quality is good.

45' 50'

G = A ; flagged tree from 9-3-82
1687' @ 30° @ 52°

- a traverse of the gully of GF2

A to B 62' 312° 27° UP



@ 45' to 50' Break in outcrop
exposure on the NE side

B to C 30' 33' 7° 26° UP

C is 10' away from the rock on
the east side of gully

- @ C on the NE ridge there is

✓ saddle ~ 6' wide

287° 85° S

- could be a result of a
slump block or a fracture/shear

believe it is probably the later

C to D 67' 347° 34° UP

- stopped just short of S182-Kc

- elev. @ D 1782' @ 353

U82-K57 (D)

NE side of gully. Rock is the
greasy-gray, fine and medium grained diorite.
Rock is fresh, slightly weathered, hard,
mostly blocky.

JOINTS

✓ 75° 84° N, plane, smooth
1" to 1', generally 6" to 1'

✓ 25° 85° NW plane, smooth
1" to 8"; average 6"

310° 85° NE, face of outcrop;
plane, smooth to rd.
rough; 6" to 1'

308° 88° NE, plane, smooth
1" to 2'; generally 1"

minor 290° 52° S, planes of irregular,
smooth, discontinuous
4" to 2' where present
- in 30% of outcrop

D to E 67' 240° 10° UP

- left the outcrop at D that continues upslope @ $\pm 347^\circ$. Crossed the gully which has talus blocks covered by vegetation and are on the west ridge. STA E = SL82-11 (P 32)

The ridge here has talus blocks on. Rock is exposed on the west facing side of this ridge

E to F 51' 231° rising

- @ 25.0' edge of ridge, 2' to 3' high exposure here up & down slope
- on SL82-Kc, P 31 is at 49.0'

- 25.0' - 50.0' Talus blocks, 50% covered by vegetation

- @ 50.0' down slope end of the west ridge. Goes from 50.0' to 100' at the above azimuth

W82-188 (F)

White gray, fine to coarse grained, quartz diorite. Quartz $\pm 10\%$. Hafics comprise $\sim 20\%$. Very hard, fresh, blocky competent.

JOINTS:

✓ 305° 48° NE plane to sl. curved, smooth, 2" to 2.5", aver. 1". Most are open up to 10", tightening into outcrop, generally less than 10"

parallel to trend of gully

✓ 355° 85° W plane, smooth; visible on gully side, 1' to 1.5' towards the west.

✓ 0° 27° W plane, smooth, 1' to 10', generally around 10'

Chalk pit

✓ F to G 80' 100' 319° 57° UP
- subparallel to outcrop exposure which ends at 55.0'

- line is on the talus. Boulders
average 2' to 3'

ELEV. @ G

1881' @ 442

- across slope; bedrock exposed

- to west 15' over to 25'

- to east 28' over to (est) 48'

G to H 87
98'

328°

33° UP

- on talus slope at H it is 80%
covered up

- ridges defining the boundaries of
the gully are subdued, difficult
to delineate. Estimate of ~~in~~ across
slope:

to east 5'

to west 30'

J to I

411
51'

322°

36° UP

- continuous outcrop exposure on the
NE side

I to J

415
51.5'

297°

27° UP

- crossed the gully to the other
side. Talus is mostly covered
by vegetation, except next to
outcrop

J to K

34
39'

340°

30° UP

- continuous outcrop from J past
K, upslope. Outcrop exposure is
up to 15' high

- green-gray, fine to medium grained
diomite. Hard, fresh. Rock
is loose, many joints are open,
some active spalling going on
here. Well defined joint set at
54° 36° NW

plane, smooth; 6" to 2'

70
K to L 83' 303° 33° UP

- entire segment follows bedrock
- bedrock is continuous all the way up, average 15' high

ELEV. @ L

1942' @ 52°

estimate the gully is ~60'-65' wide
@ ~60.0' to 78.0' outcrop is loose blocks

JOINTS

✓ 293° 62°-80° NE; curved, smooth
6" to 3'; generally 2'
- forms face of outcrop
- ~50% are open, up to 1/2"

✓ 38° 76° NW; plane to sl. irregular,
rough. Spacing 6" to 3'
aver. 1.5' to 2'

- normal to trend of gully,
blocks spalling from.

Most are open to 1/4"

86° 30° S plane, smooth
5" to 5'; average 2'
- open, up to 1/2"

61
L to M 71' 312° 30° UP

- @ 41.0' continuous outcrop exposure ends. Ridge relief is now ~8'.
Rock is probably thinly covered by vegetation

- @ ~38' new joint set.

45° 28° SE plane to

sl. curved, smooth to
sl. rough; 4' to 5'
aver. 4' to 5'

- 4' zone, spacing 6" to 1'

64
M to N 69' 316° 23° UP

- across from here, small depression,
3' w/c the gully 25' wide

N to O 38' 346° 11° UP

- apex of gully, w/c gully; trends
305°; subrounded boulders
at this point. Depression is 8' wide

ELEV. @ O

2026' @ 60°

41

O to P 49' 290° 34° UP

- vegetation covers the slope
slight irregularities, may
be boulders.

Plot
P to Q
put

17

P to Q 99' 330° 15° UP

- @ 16' to 23', large boulders
7' diameter

- same as above

98

Q to R 101' 302° 14° UP

- same as above

- intersection w/ SL82-10

98

R to S 100' 359° 10° UP

on SL82-10

96

S to T 100' 359° 16° UP

on SL82-10

- subrounded boulders ~80%
covered

76

T to U 100' 359° 12° UP

98

U to V 100' 3° 11° UP

V is RE M survey pt

SL BH-11 SW 1981

2212' @ 62°

end of SL82-10 is ~20'
further at ~0° instead of 3°

Watana

2414' @ 64°

In the gully for GF-2, no shear
or fracture zones were observed. The
traverse up this gully provided a good
X-section of the rock and would have
picked up any E-W discontinuities.
With the results of mapping in the
"Fins", there doesn't appear to be
any major E-W discontinuities which
would parallel the diversion tunnels.

Traverse of the 18/4/82 K/U

9-5-82

It's cloudy and very windy. Will try tracing the "Fins" and "Fingerbuds". Later we will work on defining the pluton boundary, adding to the data in existence.

Watana

2260' @ 7⁴⁸ @

To do:

- 1) survey area in field
- 2) extra seismic line
- 3) inst. D in select channel

PHOTO: CIR 16-179

Following the Fins to the NW. At E. creek, N drainage, short abrupt changes in the stream course. This appears to line up with the "Fins" feature on the Swintna & at Tonsens Creek.

WBZ-187

Massive outcrop mostly on the NE side of the creek. Rock is a grey, medium to coarse grained, quartz diorite. Similar in appearance to what's at the dam site. Very hard, fresh competent. Major joint set

330° 80° SW

Outcrop is 150' long. Approx. 500' downstream the creek has a 90° change in its course, all in overburden. They are 200' to 300' apart.

Flew to the SE but didn't pick up anything that could be directly tied to the "Fins" feature. Estimate 330°

Fins feature N-S orientation. Went south to Big Creek but didn't see anything. Likewise we went north to Tonsens Creek, nothing was visible.

Will now trace the Fingerbush
to Tower @ 300' to the NW. Later to the
SE, no luck at all.

W82.190

Light gray fine to medium grained
granitic dike. Quartz 25-35%. Mafics
10-15%. Dike is 6" to 1' wide, highly
fractured, very hard. It is intruded
into the highly altered biotite
granodiorite. (Dike is unaltered). Thgt
is breaking down along the grain
boundaries, some feldspar has gone
to clay minerals. Exposure is
minimum of 50' high $\pm$ 200'
across.

Dike orientation:

80° 49° N

Small offset of dike, 1 1/2" along
a 8° 85° W shear $\leq$ 1" wide

On E. Creek, north drainage,
west side of creek.

At 30' higher up 12' from the top of
rock there are two gouge zones exposed
the higher one is oriented 295° and the
lower one 270°. The gouge is a pale
yellowish gray, sandy clay, moderate
plasticity. Orange to red orange in places.
270° ranges from 6" to 18"
255° " " 1.5' to 2'
Thgt is altered on both sides. Approx
10' spacing. Too have a shear zone
13' to 14' wide. Zone is dipping
 $\approx$ 73° N

TOD:

Returned to Watana, will do office
work.

Had no luck in tracing the "Fino"
and Fingerbush in either direction. Glacial
sediments obscure any possible topographic
expression of these features if they are
continuous. Did see a large E-W
shear in the drainage north of Borrow
site E.

20 Film K82-4 ~~last~~

9-6-82

It's a mostly cloudy morning, clear to the SW so maybe the day will get better. Start pluton boundary / regional mapping.

Starts in FOG CREEK AREA

Watania 2260' @ 73° @ 50°

Photo: 445-30.32

11/82-191 (80-249)

Outcrop of baked argillite ~20' high and ~200' long. Close to very closely jointed. Scree slope at base of entire outcrop, pos.

generally less than 4". Medium gray, fine grained to rock, has lighter layers w/ "may be slightly sandier due to weathering - pale

green. Oxidized to a yellow brown Bedding plane cleavage

* 39° 87° NW to vert; 1/4" to 4"

close to very closely spaced

Minor fold - axial plane 315°, 56° NE. Wavelength 6' to 55"

Thin quartz veins within $\leq 1/10"$

JOINTS: others major w/ bedding

305° 87° SW plane, smooth
2" to 6"

350° 12° E plane, smooth
2" to 8" over 4" to 6"

may be same

315° 80° NE plane to sl. irregular
1' to 4'

minor } 80° 60° S plane, smooth;
≥ 5'

Rock is hard, well indurated. Outcrop is incompetent due to jointing/fracturing. Some CO₂ along joints, sulfide mineralization

Felsic intrusive, medium grained aphanitic w/ medium grained plagioclase phenocrysts. Appears to be a dike 4' to 5' wide with an approx. orientation

280° 20° S

Fe stained. Joints crosscut both rock types. Also highly fractured

W82-192 (W80-253)

Outcrop of argillite ~12' high and ~50' long. Medium to dark gray, slight reddish tinge, ^{very} fine grained rock. Very hard, well indurated. Oxidized in places to an orange, red-orange. To cooled to determine any bedding. Some occasional thin ^(1/8") lighter layers within. Biotite ~2%, some recrystallization.

NOTE: As we got closer to Intrusives, saw more & more recrystallization in ... argillite.

W82-193 (W80-254)

Gabbroic, dark gray to dark greenish gray, medium to coarse grained rock. Very hard, sl. weathered. This biotite, hornblende, dark colored feldspars. Outcrop is 7' high and 30' long.

85° 64° N, outcrop face plane to sl. curved

320° 70° SW plane, sl. rough
1' to 3'

W82-194

Rock is a fine to mostly medium grained, light gray to yellowish orange, ^{possibly} due to oxidation. Biotite granodiorite or diorite. Didn't see any quartz. CI ~ 20%

Hard, slightly weathered, not well exposed here have to go farther downstream. Not the typical T35d, may be part of diorite.

Appears that the pluton is more mafic towards the contact - why. No exposures of contact. Ksg, - Gabbro, - Diorite.

W82-195

Outcrop of medium to dark gray, fine to very fine grained argillite. Hard, slightly weathered, Fe staining, CO₂ veining. Some quartz veins crosscut, up to 1/2" wide. Bedding not well defined oriented; 32° 44° NW

JOINTS:

32° 44° NW plane to sl.
 curved, smooth; 1/4" to 2"
 face of outcrop 285° 35° N plane, smooth
 6" to 3', aver. 2' ?
 60° 50° SE plane, smooth,
 1' spacing
 305° 65° NE plane, smooth
 2" to 1'; aver. 4"

Some sulfur staining on outcrop
 Outcrop is 10' high, ~35' long
 Well indurated especially closer to the
 contact

W82-196

Outcrop across the gul^y, where the
 contact is. Medium grained, medium
 gray, diorite. Mafics 20-25%.
 Hard, fresh to sl. weathered, small
 blocky outcrop, competent. Biotite,
 maybe some kfs., no quartz.
 Small outcrop at creek level
 Resembles the diorite at the site
 Outcrop is loose

W82-197

(80-215)

Well defined joint set, approx band
 295° 80° N
 of the gully. Rock is well indurated
 here. Bedding

5° 51° NW plane, smooth
 Small fold

295° axial plane, vert.
 plunge 32° W
 wavelength 4' to 5'

W82-198 (W80-220)

Highly fractured and sheared outcrop
 of the light gray, very fine grained argillite.
 Slightly to moderately weathered. Entirely
 iron stained, some sulfur staining.
 Rock is moderate hard to hard, incompetent
 Shear zone ~5' wide with three
 gouge zones, very closely jointed.
 Gouge is a silty clay to sandy clay
 Red brown to orange to pale yellow gray
 The gouge zone are 8", 4", & 1".
 Photo K82-5; 14, 15, 16-17.

Gouge is moderately plastic. Orientation
 292° $74^{\circ}S$ *

Block to the S side may have slumped
 Bedding: $\sim 25'$ to the W of the shear:
 60° $70^{\circ}NW$ plane smooth
 Quartz veins throughout

Approx. $25'$ spacing from the
 above shear is a shear along the
 bedding. It is a two inch gouge
 zone the same as above
 Orientation

49° $62^{\circ}NW$ *

Light & dark beds are visible in
 the argillite

Bedding orientation $\sim 100'$ from
 the major shear
 55° $55^{\circ}NW$

Bedding orientation $\sim 300'$ down
 the creek from the shear, at end
 15° $18^{\circ}W$

of outcrop. There is a change
 in bedding
 Outcrop is $\sim 355'$ long

- walked up on the hill on the north
 side of this drainage towards the
 volcanics. Small outcrop of highly
 fractured, baked, well indurated,
 slightly recrystallized argillite, It's
 shattered

- think this was ~~the~~ basaltic

N 82-199

Small outcrop of amygdaloidal basalt?
 the rock is a medium to dark gray, aphanitic
 groundmass with medium to coarse grained
 white quartz phenocrysts which have filled the
 vesicles. Sampled. Low density & light
 Highly fractured, crumbles easily.
 Looks shattered. Approx. 30% of rock
 is amygdaloidal

W82-200

Hematitic stain on all outcrop faces, red brown. Dark gray aphanitic groundmass with fine grained quartz inclusions which fill the vesicles, amygdaloidal. Outcrop at ~ river level. Higher in elevation the amygdaloids may be larger.

Slickensided surface, oriented.

30° 60° NW (dip to)

E side moved down w/ respect to W.

Outcrop is shattered, rotten. Rock breaks apart easily - incompetent. The phenocrysts are generally coarser at the surface, finer grained into the outcrop. To shattered to get any joints. Amygdaloids comprise 30-40%.

W82-201

Felsic dike ~ 30' wide, highly fractured & jointed. Oxidized to a yellow orange.

W82-202

Massive outcrop of a medium gray, fine grained groundmass with fine to medium grained dark gray phenocrysts - of biotite & maybe some hornblende (?) KOW feels that it is a volcanic ~~rock~~ HPB thinks it is a recrystallized (argillite). Hard to very hard, blocky competent. Only with a thin section may the rock type be known.

W82-203

Dark gray, fine grained argillite. Hard to very hard, slightly weathered, Fe staining, lots of CO₂ which has precipitated on the outcrop face in places. Highly fractured, jointed. Has some light colored beds.

Bedding is

63°-77° 75° N

Joints:

330° 66° SW

63°-77° 75° N

PHOTO: 4-4-29

W82-204

Large outcrop on the Sumatra
~60' across and 15' to 35' high
light green andesite porphyry. Has
fine to medium grained white plagioclase
phenocrysts. Contains xenoliths of
argillite up to 1/4". Hard, massive
competent

JOINTS

5°	80° E
90°	vert
50°	vert.

W82-205

South side of Sumatra River across
from BORROW SITE 'E'. Volcanic
flow; andesitic basalt to basalt. Fine
to mostly very fine grained, dark gray
rock. Phenocrysts of hornblende, ~5%.

→ Has the small blocky, rough surface
texture. Very hard, fresh competent.
Fractured up surface.

W82-206

On 'E' side at the beginning of
rock outcrop, in upstream direction. From
1700' elevation to the top of the cliff
are volcanoclastic sediments and maybe
some volcanics. Pale brown siltstone
along with a green fine grained rock
which is either a volcanoclastic or volcanic
extrusive. Bedding is visible and it is
subhorizontal & dips 10°-15° to the
S-SE. The rock is hard, fresh.
Notes are from the top of the cliff

Bedding orientation from outcrop
304° 17° SW andesite

Pale green, fine grained, ~~siltstone~~ (?)
Concordant fracturing. Occasional sand
grains within. A 6" layer of a
conglomerate - volcanoclastic. Inclusion
up to 3/8" argillite, quartz sand grains
make up ~50%. Groundmass is a
medium green, fine grained material

9-7-82

It's cloudy & overcast, light rain. Will continue the bedrock regional mapping. Will start in the Borrow 'E' area and work upstream of.

Watanabe

2260' @ 7¹³ @ 46°

PHOTO: 4-3-29

W82-207

Greenish gray, medium grained diorite or possibly quartz diorite. Does have some quartz probably ~ 10%. Rock is massive hard to moderate hard as a result of slight weathering. Most of the outcrop is loose in this location beneath highly altered & sheared outcrop which we looked at on 9-5-82. Rock resembles that which is found at the dam site with the Tbgd, outcrops

above. Can't really say yet if Tbgd unit overlies or what the relationship is

Joints - are approximate

300°

37° NE

45°

vert

285°

78° N

ELEV.

2160' @ 75° @ 47°

- went farther downstream, downslope on another ridge

W82-208

Greenish gray, mostly medium grained diorite to primarily a green - white gray fine to coarse grained diorite. Quartz comprises 5-10%. mafics are fine grained, ~ 20%. White, sodic plagioclase tabs are medium to coarse grained. Could be the transition into the much more sodic Tbgd unit. Hard, fresh to slightly

weathered.

ELEV.

2046' @ 8²⁷ @ 47°

On the Suaitna River just upstream of
Tarsena Creek.

PHOTO: 4-4-29 & 4-4-31

W 82-209 (80-50, 51) at river level

Large outcrop of volcanoclastic
sediments. Interlayered sequence of sediments

Alternating layers of a siltstone and fine
grained sandstone. The siltstone layers
have shaly weathering, 1" to 2" thick

The more massive sandstone units are
4" to 10" thick. Siltstone units are

brittle, possible slight movement along
resulting in being highly fractured.

Siltstone is a buff tan to light green
color. The sandstone is a light gray
slightly quartzitic rock, very hard.

Bedding:

35° 16° W

stress
taken
up
unit.

JOINTS: generally closely jointed/fractured

20° 76° E

320° 78° NE

80° 75° S

Shear zone approx 6' wide, very
closely jointed with some occasional
thin seams (~1/4") of a light colored
grunge. Oriented:

325° 78° NE

Difficult to tell if any on layer passes
through the shear

Further upstream near the end of the
outcrop there is another 4' wide shear
zone which probably parallels the 320°-
325° set.

Photo K 82-6, 4

Also exposed is a medium gray, argillaceous
unit, very hard, dense. Some of the
original bedding can be seen, light &
dark colored beds

W82-210

At the top of rock cliff exposure.
Have about a 40' thick cap rock which
has a top elevation here of
1691' @ N⁵

The rock is a green, fine grained to
aphanitic andesitic rock. Has phenocrysts
of quartz up to 1/2". Rock is very
hard, massive, competent. Mafics comprise
roughly 5-10%, some are as large as
medium grained. Mafics hornblende &
bistite. Could this unit be a volcani-
clastic. This unit overlies the volcani-
clastics below.

Outcrop of same material on west
side as walking down to river

1499' @ 11³⁰ @ 50°

- believe w/ rain, altimeter
has drifted a great deal in
the last 15 min.

W82-211

Downstream of main outcrop & in from
the river is a large outcrop of green volcanic
whether it is andesite is still a question. It
also have nuggets of quartz (don't think
that it is feldspar). Very hard, massive,
competent. If bedding exists, it is:

52° 24 NW

W82-212

Green andesite, sampled. Outcrop
is slightly weathered, some porphyritic
andesite. On weathered surface, phenocrysts
stand out 20-30%; plagioclase.

Photo: 2-6-5; 4-4-31

Wakana 2183' @ 11¹²

Photo: 4-4-31

W82-213 80-107, 81-

Andesite in Quarry A, sampled

W82-214 80-113

Andesite in Quarry A. Duncan's

diorite !!

W82-215

Photo: 2-6-5

Large felsic dike, oriented:

295° 60°S

Estimated width 30'. Light green-gray, aphanitic to very fine grained rock.

Hard to very hard, Fe stained, slightly weathered, highly fractured. This has intruded into the argillite.

Small shear in the argillite oriented:

310° ~ 70° NE irregular

Less than 1' wide. There is also a joint set parallel to

Dark gray to light green gray, interlayered, fine grained rock - argillite

Very hard, massive, competent. Oriented, bedding plane cleavage

70° 70° N

Fracture zone, could also be sheared, 2' to 2.5' wide, very closely jointed. Oriented:

325° west.

Another fracture zone parallel to bedding. Oriented:

60° 72° NW

The river follows this shear zone which is 5' to 6' wide of very closely jointed rock, spacing is $\pm 2''$.

Bedding

50° 70° NW

At the last major slope bedding changes to

42° west.

Argillite is interlayered with light & dark layers. Very hard, well indurated, competent. Quartz stringers up to $\frac{1}{2}''$ thick, discontinuous. Has a dioritic dike up to 6" wide. It is a green gray, fine to medium grained diorite. It has been offset along an old shear, approx 6", normal displacement.

Joints:

320°

72° NE

one face of outcrop

42°

west.

W82-216

Gray, medium grained biotite diorite.
Biotite comprises 30-35%. Some coarse
grained white plagioclase xstls. Rock is
very hard, fresh, massive, competent.
Outcrop is at river level and is ~100'
long, 5' to 8' high.

- walked upstream

W82-217

Outcrop of argillite at river level.
Rock is interlayered with slight & dark
layers, generally $\approx 1\frac{1}{2}$ " thick. Very
hard, well indurated, massive, competent,
fresh. Bedding is oriented:

58° ... 81° SE

Joints:

320° : vert. ; trend of outcrop

310° 70° NE

305° 20° SW

No outcrops were seen between here

& 82-215

- just upstream ~50' is a dike
which has intruded the argillite. It
is a pale green-gray, very fine grained,
with medium grained biotite phenocrysts,
felsic (?) dike. Dike is oriented
270° .. high angle to vert.
Phenocrysts comprise 5 to 10%. Dike is
approx 2' wide.

Inclusion of dioritic material,
fine to medium grained, light gray
xtallic rock. No chill zone. Blob
within the argillite up a feeder dike
~4" wide trending off to the N/E

W82-218

Large outcrop at river level of a green-
gray, medium grained, quartz diorite. Mafics
comprise ~30%, chiefly biotite. Quartz ~10%.
Fresh, very hard, competent. Have a foliated
texture of the mafics, gneissic?

Approx. orientation of foliation
15°, high angle to vertical

JOINTS:

312° 67° NE; face of outcrop

80° 74° N.

23° 66° SE

There are irregular veins & dikes. They are granitic: fine to mostly medium to coarse grained. Mafics comprise ~ 15%

There is also some argillite xenoliths & blocks within the diorite. Bedding is oriented

60° 80° NW

and is parallel to the contact. The contact is very sharp with no chill zones. Argillite is generally oxidized.

JOINTS

65° 20° SE well developed

315° 62° NE

W 82-219

Outcrop of the dark grey, very fine grained argillite. Hard, fresh, competent. Bedding 30° 65° NW

W 82-220

Interbedded sequence of light & dark muds. Argillite is very fine grained, hard, slightly weathered. Beds are oriented:

53° 62° NW

Mostly Fe stained, some shaly weathering

JOINTS:

320° 65° SW

320° 80° NE

+ bedding

At the far end of this outcrop the argillite has been intruded. The sill (?) is a pale green-gray porphyritic rock. The groundmass is fine grained. Mafics comprise 10-15% & are fine grained. White plagioclase phenocrysts are fine to medium grained & comprise 10-20%.

The intrusive is subparallel to parallel to bedding

57° 70° NW

It is ~ 1' wide. Sampled

W82-221

Large outcrop of argillite. It is highly fractured, slightly weathered, CO₂ staining throughout. Outcrop is totally incompetent, can't pick up bedding. Must be a major shear or fracture zone nearby.

Prominent joints

300°

15° 75° E

TOD:

Did not see the diorite - argillite contact. Saw some interfingering of diorite - argillite or blocks of argillite in the diorite. Believe it is the former.

9-8-82

It's overcast and raining. Ceiling is at ~ 3000'. Will map bedrock and bedrock elevation along the Switna from the Dam site to just upstream of Watana Creek.

Watana

2260' @ 72° @ 45°?

Going upstream along Switna from the Karib along south bank

A Diorite Tophyry in saddle
EL 1720

B Argillite
EL 1590

C Diorite
EL 1780
lowest point at 1780

D Diomite
EL 1960 - 2000

E Argillite
EL 1810
from Deadman Creek

F ?
EL 1940

G Argillite
EL 2000 - 2050
up west side of rectangular
drainage area
EL 2080
on west drain

H Argillite
EL 1940

I Argillite(?)
EL 1820

J ?
EL 1700

K Argillite
EL 1910

L Argillite
EL 1820 - 1860(?)

M Argillite
EL 1820 maybe a slump
and not outcrop

N Argillite
EL 1920 - 1940

O Argillite
EL 1780

P
EL 2000

Q Argillite
EL 2070

R Argillite (?)
EL 1900

S Argillite
EL 1820

T Argillite
EI 1860

U ?
EL 1900

V Argillite
EI 1730
possible slump

W Argillite
EI 1900

X ?
EI 1900

Y ?
EI 1940

Z ?
EI 1820-1880

AA Metabasalt
EI 1940
area sampled for WCC in 1981

BB On river south bank
interbedded argillite and
conglomerate with felsic
dikes and felsic porphyry
intrusive

Assume that congl is part of
Kag

1/4 mile downstream from Tolketna
thrust fault

CC Metabasalt (?)
EI 1800

DD Metabasalt (?)
EI 1680

Possible channel between
CC & DD

EE Metabasalt (?)
E/ 1540

FF Metabasalt (?)
E/ 1700

GG Metabasalt (?)
E/ 1760-1840

HH Metabasalt (?)
E/ 1780

II Metabasalt (?)
1780

JJ ?
E/ 1800

KK ?
E/ 1800

across from Watson Creek

LL ?
E/ 1680

MM ?
E/ 1880-1980

North bank

NN Metabasalt, possibly R
E/ 1600

Dark gray to dark greenish
gray, porphyritic volcanic
green clay from clasts,
underlain by basaltic

OO ?

PP Metabasalt
E/ 1780

QQ Metabasalt
E/ 1660

RR Tertiary sediment
E/ 1580

SS across creek
E/ 1750

SS Argillite
EI 1750

TT Argillite
EI 1750-1860

UU Argillite
EI 1830

VV Argillite
EI 1850

WW Argillite
EI 1900-1950

XIX Argillite
EI 1800-1820

YY Argillite
EI 1750

ZZ 7
EI 1720

Deadman Creek
Dike / G.D. mapped
outcrop extent in relic
channel area

Photo: 2-6-5

Trusser Creek
mapped outcrop extent
in relic channel
area

Photo: 2-6-3

OTHER PHOTO'S USED:

-for the Frog Lake - SUSINA RIVER
RECONNAISSANCE

2-6-3

2-6-5

2-6-6

2-6-8

2-6-9

2-6-10

2-6-12

9-9-82

It was cloudy & foggy. Worked on air photo interpretation of Relict Channel/Borrow I area & Borrow E & I.

Flagged the access route in ten locations, Orange flagging, large X's. With the aid of someone in a helicopter there should be no problem in finishing the flagging. There are two short steep locations the lower one down to the river will be the most difficult. The one after crossing the saddle between the depressions is not as bad. This one could be shifted to the east along the ridge. (all discussions are from Tusena to WTA camp)

cat may
need to
help

9-10-82

It's cloudy & overcast with an approx 6500' ceiling. Some low clouds are still in the valley, but they will burn off.

Will log core from summer program

AH-20 - 4 core

RUN 1; 137.0 - 141.5 REC $\frac{4.5}{4.5}$ ROD $\frac{2.45}{4.5}$

Diorite, orangish-brown to green-gray medium ^{to coarse} grained rock. Matrix composed 25% - 35%, Seem to be all biotite. Approx 5% quartz. Rock is hard, slightly to moderately weathered.

Highly oxidized from 137.0 - 141.3' Fe staining
145.2 - 151.5 " "

Generally in the highly oxidized zone the joints are moderately weathered, friable

there are quite a few rehealed joints/fractures

141.0 - 141.3 Core broken; pieces $\leq 0.2'$, aver. $0.04'$.

RUN #2 141.5 - 146.5 Rec $\frac{4.2}{3.0}$; RQD $\frac{2.2}{3.0}$

141.5 - 142.65 Diorite is fresh

145.1 - 154.1 Highly fractured & moderately weathered zone. Jointing is close to very close, less than or equal to $0.4'$.

145.2 - 146.5 Core loss of $0.8'$.

RUN #3 146.5 - 151.5 Rec $\frac{4.35}{5.0}$ RQD $\frac{1.0}{5.0}$

4 H-21 NQ core

RUN #1 179.0 - 183.7 Rec. $\frac{4.7}{4.7}$ RQD $\frac{3.55}{4.7}$

Quartz Diorite: Light gray, fine to mostly medium grained rock

Quartz comprises 10-20%, Alkalies $\approx 15-20\%$, chiefly biotite.

Contains small inclusions of fine grained diorite up to $0.1'$.

Very hard, competent, fresh.

Slight Fe staining & CO_2 staining on joints. Jointing is close to moderate close.

st. penetration along joints $\approx 0.05'$

RUN #2 183.7 - 188.7 Rec. $\frac{3.5}{4.0}$ RQD $\frac{2.6}{4.0}$

AH-22

HX

0.0' - 9.9'

Overburden

Run #1 9.9' - 14.0' Rec. $\frac{3.9}{4.1}$ ROD $\frac{0.4}{4.1}$

Qtz. Diorite - white-gray, medium grained rock. Mafics comprise 15-20%
 Qtz = 10%
 Hard to very hard, competent, fresh to slightly weathered.

Numerous healed joints/fractures

All joints are slightly weathered,

Fe stained, some CO_2 coating,

generally no penetration of

staining away from joints

Mafics are chiefly biotite, with

some hornblende(?)

1.3

9.9' - 12.6' highly fractured &
 broken by drilling. Core loss
 of 1.1'.

Run #2 14.0' - 19.0' Rec. $\frac{5.0}{5.0}$ ROD $\frac{1.6}{5.0}$

14.9' - 15.3 Fracture zone, very
 closely jointed, Fe staining

16.3' - 19.5' Fracture zone, high angle
 joints ~60°, very closely spaced.
 Fe staining

Run #3 19.0' - 24.0' Rec. $\frac{5.0}{5.0}$ ROD $\frac{4.9}{5.0}$

19.2' - 24.0' Healed qtz. diorite, which

is very highly fractured, most are
 Fe stained, some are healed with
 thin chlorite filling - core

breaks along easily during drilling.
 Jointing is close to very close.

Joints are Fe stained with
 some chlorite or CO_2 along
 joints

19.5' - 20.0' Core is badly broken,
 22.3' - 24.0' angular pos.

21.3 Shear, "10" of breccia - gouge,
 friable. Joint is 50°

23.6' - 24.0' OLD SHEAR, Breccia,
 friable, incompetent

AH-24 NR

RUN #1 37.0'-41.5' Rec. $\frac{4.5}{4.5}$ RQD $\frac{4.2}{4.5}$ RUN #2 41.5'-46.5' Rec. $\frac{4.2}{5.0}$ RQD $\frac{3.3}{5.0}$ RUN #3 46.5'-51.5' Rec. $\frac{4.9}{5.0}$ RQD $\frac{4.25}{5.0}$ RUN #4 51.5'-53.9' Rec. $\frac{2.4}{2.4}$ RQD $\frac{2.4}{2.4}$ RUN #5 53.9'-56.0' Rec. $\frac{2.0}{2.1}$ RQD $\frac{1.2}{2.1}$ RUN #6 56.0'-58.9' Rec. $\frac{2.9}{2.9}$ RQD $\frac{2.6}{2.9}$

37.0'-46.05 Andesite with xenoliths of light gray fine to medium grained diorite and some argillite, less than 0.15' in diameter. Andesite is a light green-gray andesite porphyry. Contains phenocrysts of white plagioclase. Groundmass is aphanitic. Diorite comprises 20-30%. CO₂ along joints.

44.0-45.0 Shear zone, has a couple of breccia gouge seams. ^{Light} yellow orange silty-sand breccia gouge zone is oxidized. Estimated core loss 0.6'.

46.05-56.0 Green gray, medium grained diorite. Hard to very hard, massive competent, fresh. Joints have CO₂ coating slight iron staining. Jointing is generally close to moderate close.

48.8' to 49.3 Shear zone. Rock has been included by andesite. May have been a vein. Some orange-brown silty gouge. Fracture along joints.

49.8'-51.3 Healed diorite breccia, very hard competent. (May have been healed with CO₂)

AH-17 NQ

RUN #3 218.0' - 221.0' Rec. $\frac{2.9}{3.0}$ RQD $\frac{2.55}{3.0}$

RUN #4 221.0' - 226.0' Rec. $\frac{4.3}{5.0}$
RQD $\frac{1.1}{5.0}$

RUN #5 226.0' - 231.0' Rec. $\frac{4.8}{5.0}$ RQD $\frac{2.05}{5.0}$

218.0' - 221.0' Light gray, medium grained quartz diorite. mafics comprise ~20% to 25%, quartz comprises 10-15%. Very hard, competent, fresh. CO₂ along joints, some chlorite. Mafics consist of ill. & biotite. Shear zone

221.0' - 226.0' A close to very closely spaced joints, some of core was also broken by drilling. Pcs. less than 0.35', generally less than 0.15'. Couple of shears with pale green breccia zone less than or equal to 0.2', generally a sandy silt. Core loss 0.3'.

227.6' - 229.1' Fracture zone. ^{very} closely spaced joints. Rock is competent though. CO₂, ^{very} light Fe staining

W 82-26

Bulk Sample sampling

Pit 4f OUTWASH UNIT E/F

Max particle size 3.0'

Volume of > 3" est. 25%

Weight > 3" est. 30%

- one 6" to 7" cobble taken out

- Gravelly, silty sand
or gravelly sand, trace to some silt

PIT #3 TILL UNIT G

brownish-gray gravelly-clay
above with a blue-gray gravelly
clayey till. Sampled the blue-
gray till. Approx 30-35%
cobbles and gravel. Generally
cobbles < 4" but up to 1"
Weight % > 3" $\approx$ 10%

W82-44 PIT #2

BULK SAMPLING.

OUTWASH UNIT E/F

-fine, light brown gravelly sand
w/ trace silt.

Pit #2 is 3' below Pit #1

Max particle size 3.5'

Weight % > 3" 30-35% over
(low of 10%
high of 70%)

W82-45 PIT #2

BULK SAMPLING

Moderate brown gravelly clay
overconsolidated. P.T. location
is ~ 100' east of Pit #1 @ the
same elevation.

Max Particle Size $\approx$ 6"

Weight % $\geq$ 3" $\approx$ 5%

Gravel to Cobbles $\approx$ 20%

9-15-82

It's mostly sunny, rained until ~ 9:30. Worked in the office & lab in the AM. Will work on collecting bulk samples & revisiting several sites on Tussera Creek. RCP & MFB

WATANA

2260' @ 12.50 @ 67°

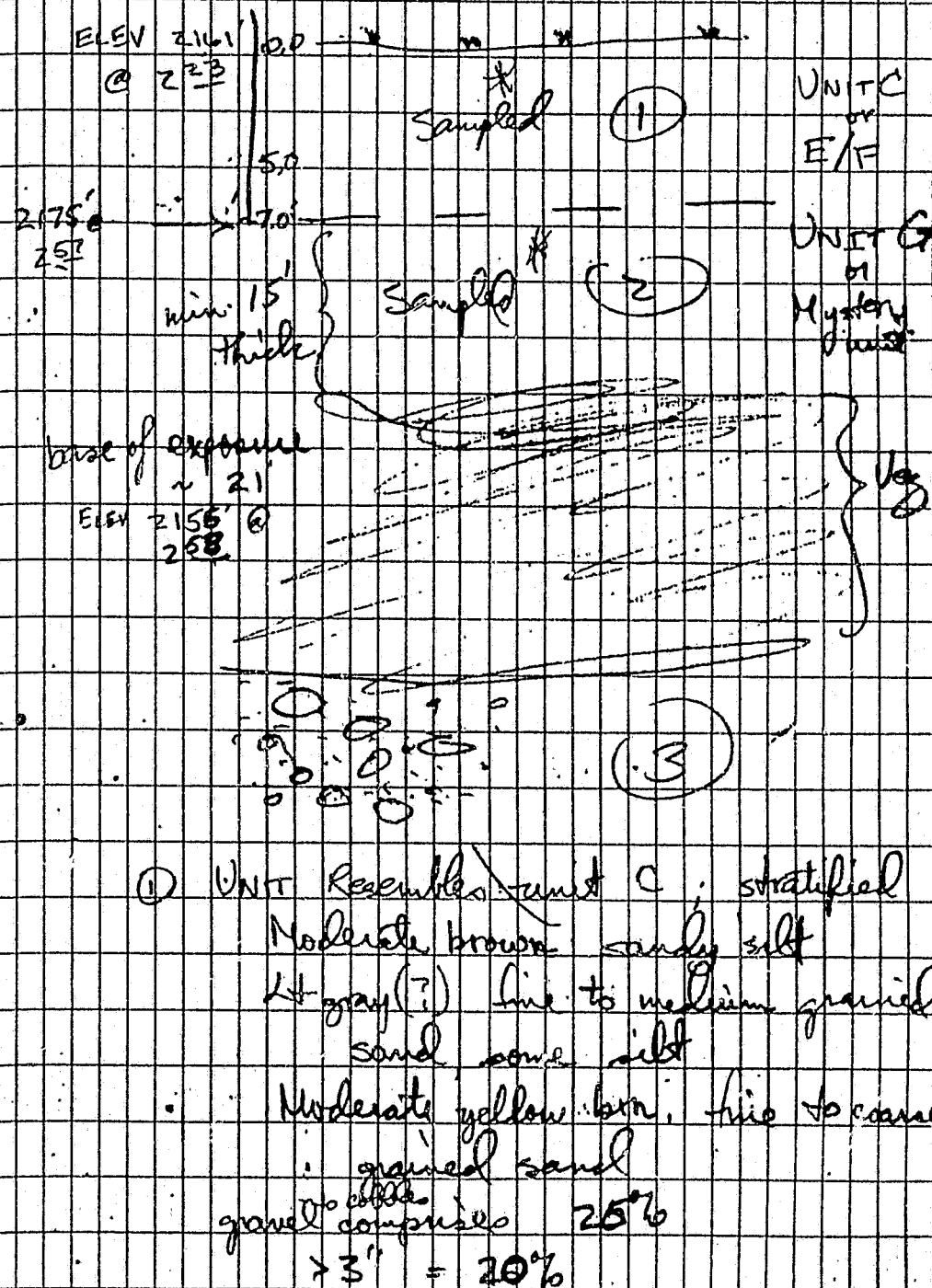
W82 7#

BULK Sampling of UNIT C
Sampled at 3.0' to 4.5' down from top.
Material is a light moderate brown, gravelly sand some silt

Max Particle size 12" (maybe up to 24")
> 3" material 25-35%

Sand is primarily fine to medium grained
Gravel to cobbles are mostly subrounded, some subangular, trace rounded. Appears to be some stratification - crude

ELEV. 2174' @ 155



Moist, moderate hard

W82-75

- (2) Medium brown, gravelly silt, some clay. Moist, hard. Gravel to cobbles subrounded, subangular. Trace sand. Sampled - 1' - 2' below contact.

Max particle = 4"

> 3" = 10%

gravel to cobbles 30-35%

Thin ($\leq 1\frac{1}{2}$ ") layers of moderate brown sand layers.

- unit is sandier than the till normally seen.

TILL UNIT

Could this be the mystery unit rather than G. If so, E/F is nearly non-existent

W82-76

- (3) ELEV. TOP OF

2104' @ 30'

Moderate yellow brown gravelly sand well graded. Moist, moderately dense.

higher in places { Max Particle 2'
> 3" 40-50%
gravel to boulders 60-70%

Seems to be to coarse to be unit E/F

UNIT H?

Min. Thickness 35' to 40'

W82-91

- (1) Moderate brown sandy gravel, trace silt. Moist, moderate dense

Max particle 15"

> 3" 10-15%

gravel to cobbles ~ 60%

(sampled) 3.5' below surface
Unit E/F?

Upper Surface

2080' @ 5'

~ BOT OF Exposure

W82-92 2054' @ 5'

- (2) Exposure of dense sandy gravel; trace silt. Very compact. Yellow brown, Min. thickness ~ 35'

ELEV 2002' @ 5'; exposed min 10' higher

Max particle $\approx 2.5'$
 $> 3'' \sim 20\%$

gravel to boulders 70-80%

Gravel to boulders, subangular to rounded, is an abundance of $\frac{1}{4}''$ to $1\frac{1}{4}''$ size gravel uncharacteristic of any place else.

Could this be Unit H. When the glacier overrode the area depositing Unit G, the weight compacted this unit.

TOP OF UNIT Exposed
 2037' @ 5³¹

- walking back upslope, mostly cobbles exposed. If Unit G is between these exposures, it is thin to nonexistent. Based on the float rock I would have to say Unit G is not here.

Wakana

2424' @ 6¹⁹

9-16-82

Cleared up in the morning. Worked on access road, discussions of surveyors, archeologists, and logging of the rock core.

Chased a grizzly down into Tsusena Creek.

Flew the access road with T. Cuthin, E. Olson, & B. Evans. The access road was completely flagged, had to use help. Fine.

AH-26

HX core

Run #1 / 103.5' - 104.9'
 103.5' - 104.9' DIORITE - greenish-gray medium grained rock. Matrix composed 20-30%. Fresh, hard. Jointing is close to moderate close. Slight Fe staining on joints - very little penetration along joints.

107.5' - 108.2' Numerous healed fractures. Chlorite & calc. Rock is hard

RUN #2 049' - 1099' REC = $\frac{50'}{50'}$ ROD = $\frac{3.2}{50}$

9-17-82

It's overcast with the ceiling at 5000'. Some fog, but it will burn off. Will get the archeologists & brushers squared away on the seismic lines first. Will do some mapping in DEADMAN CREEK

Watawa

2260' @ 8°

W82-29

ELEV. TOP OF CLIFF
2293' @ 8°45' (2291')

ELEV. BOT
2162' @ 8°55' (2159')

Tan sandy-gravel, trace silt. Wet. Moderate
% > 3" ≥ 90% (~95%) dense compact

Max Particle ~ 7'

Matrix silty-sand ~ 30-35% fines

Stratified 342' 25' N-SW

Some occasional thin ($< 1'$) silty-sand
to sand lenses discontinuous $\leq 10'$ long
Gravel to boulders, subangular & subrounded
Matrix is like that of Unit E/F
Orientation of stratification
355° 30°-40° W
Talus slope beneath it.

WS2-222

At least 40' up from the base of this
soil exposure. Not sure how much of
this exposure is wash beneath the elevation
stated:

ELEV.

2234' @ 9.47 (2229')

Yellowish brown to tan sand,
with some silt layers; poorly graded
uniform. Layer approx. 6' thick.

Just show yellowish brown, gravelly
sand. Primarily gravel, some cobbles
subangular some subrounded, ~40%.

Material is slightly oxidized. Fine
sand to coarse sands, well graded.

Near the top 7' to 12' below the upper
surface. Silty sand to sandy silt.
Sands are generally fine grained. Poorly
graded. Tan to light gray. Occasional
cobbles, trace amounts. Moist dense.

On this exposure there are many gravel
& cobbles in the wash.

Check one of RCP's drill holes
for similar material.

ELEV.

2301' @ 10¹²
(2294)

WS2-223

Light gray, gravelly sand, fairly
clean, trace fines. Gravel is
subangular to subrounded. Boulders
generally $< 2'$, occasionally larger.
Fine to coarse grained sand. Well
graded. Missing fines.

To $> 3'$ 20%

Gravel to cobbles 30-35%

Pit ~6' below surface through
vegetation mat.

ELEV. Top Surface.

2293' @ 10⁴⁵

(2284')

(2313')

Elev. top of ground 2323 @ 11:15

W82-30 PIT 1 (~10' below ground surface)

tan to brown sand, silty, some
gvl & cobbles up to ~3' mostly
subangular, occasional lenses
of sandier mat. some lenses appear
overconsolidated, dense,
well graded > 3" mat. 20% by wt.

some subrounded) Max particle ~3'

W82-30 PIT 2 (~8' below pit 1)

tan to brown sand, silty (slightly
more sand than above) some gvl &
cobbles up to 3' subangular, occasional
thin sand lenses up to 1", dense
well graded

W82-30 pit 3 (~10' below pit 2)

from tan sand, silty as in
pits 1 & 2 (slightly less silt) some

gvl & cobbles as above

Good bulk sample location
Bulk sample taken from W82-30
pits 1, 2, 3 9/18/82

From W82-222 to W82-30 there
is a bouldery cap on ground
surface max particle ~13'

(2215')

Elev. bottom of exposure 2226
@ 11:17, minimum thickness of Unit
E/F here.

Watana

2275' @ 12⁴³

-worked with archeologists met with
Cascade Drilling

9-18-82

Cloudy with ceiling at approximately 7,000 ft. Will work on the west side of Deadman Creek, finishing up. Will collect a bulk sample. In afternoon the river seismic line endpoints and HD-B will be flagged. Also have to be available for the archeologists.

Watana

2260 @ 9⁵⁰

PIT 1: 2146

WB2-224 EL 2163 @ 11:15

Gray clay covering slope approx 6" thick flowing down from above.

Material beneath is

Sand brown mostly medium, poorly graded (well sorted) clean 5-10% fines occasional gravel up to 3" subrounded to subangular. loose, becomes slightly denser w/depth. Alternating w/ layers

of tan/brown sand fine, silty approx 25% fines trace c. to med sand, poorly graded, medium to dense occasional gravel/cobbles ~ 3" subrounded subang. moist.

Max particle size ~ 12"
% > 3" 10% maximum.

(2167)

WB2-224 pit 2 EL 2182 11:32

Gray/tan Silty Sand 25-30% fines well graded sand fine co. gravel & cobbles subangular & subrounded. medium to dense, moist to wet.

max particle size ~ 2"
% > 3" ~ 30% (dry wt)

This pit is located in old inactive slump scar w/ grass growing over oriented 085°

2109'

WB2-225 EL 2136 @ 12:04
Top of rock exposed. light gray

W82-225 GWT

medium grained granodiorite
 mafic approx 20%

2180'

W82-226 PIT 1. El. 2220 1308

Gray/brown (fill) Sand fine
 to co. Silty (~25%) gnl/cobbles
 sub angular to sub rounded, very
 compact (over consolidated) hard, moist
 max particle size ~ 2 1/2"
 % > 3" ~ 30-35%

2180'

W82-226 PIT 2 El. 2220 @ 1308

Brown to gray/brown. Clay/silt/
 Sand mixture. (~50/50 mixture)
 gnl/cobbles sub ang to sub rounded
 medium to dense; denser w/ depth
 wet.

max size particle ~ 2 1/2"
 % > 3" ~ 30-35%

Slightly compact in drier areas
 appears to be fill, but slightly diff
 (not as compact, finer than usual, bigger

Cobbles/Boulders)

With depth became gray/brown fill
 as in pit 1 (sample taken for gradation
 analysis)

elevation limits of exposure

El. 2230 to 2208 @ 1309

fill still appear approx 25' el. from
 top of ridge (exposed on slope)
 el. 2202 @ 1340 appear to be
 approx top of fill

above this very fine silty sand
 poorly graded moist, brown.

Watana

2313' (to 215'

Spent the afternoon flying archeologists
 around BORROW SITE 'E'.