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Susitna Joint Venture
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52
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TO: HARZA-EBASCO SUSITNA JV DATA/CALC
XEROX TRANSMITTALS

MARCH 11, 1983

DUPLICATE SET - [illegible]
BOOKS, ANNOTATED

ATTN: MR. DICK ACKER [illegible]
VOL. 1 OF 3

DCNO 52

ACRES

Design Calculation Cover Sheet

PROJECT No. P5700

FILE No. P5700.16.996

SERIAL No. —

DUPLICATE COPIES

PROJECT TITLE SUSITNA HYDROELECTRIC PROJECT

ALASKA POWER AUTHORITY

DEPARTMENT GEOTECHNICAL

CALCULATIONS FOR: AAI 1980-82 FIELD BOOKS ANNOTATED

(SEPARATION BY CAMPSITE NOT READILY POSSIBLE)

ORIGINAL BY VARIOUS DATE / /

CHECKED BY KJW DATE 11 / 83

REV No.	BY	DATE	CHECKED	DATE
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CONTENTS: FIELD BOOKS 1-21 (see attached)

(ORIGINAL FILE P5700.16.996 has complete maps also.)

DUPLICATES

ORIGINALS IN ARCHIVAL FILE P5700.16.995

APPROVED BY

PROFESSIONAL ENGINEERS SEAL

ORIGINAL COPIES PLACED IN MAIN FILE ON CLOSURE OF PROJECT

BY Lance Duncan

DATE 2 / 25 / 83

TOTAL No. OF SHEETS not counted ~100
incl. cover, dividers

80.04.01 Form 144 A

ACRES	**Calculations** SUBJECT: Susitna Hydroelectric Project Watana and Devil Canyon Sites Geology Field Books	JOB NUMBER P5700 FILE NUMBER P5700.16.996 SHEET 1 OF BY KJW DATE 1/18/83 APP DATE

The attached documents are copies of the original Acres geology field notes. The original field books are presently stored in Anchorage. The field notes consist of traverse and geology data, layout information for seismic lines and boreholes, and samples and photographs taken. These copies contain additional notes and changes made to the original field notes based on additional data, and so represent the most up-to-date record of field information. Changes and notes added to the original are in red pen/pencil and generally consist of the following:

- Azimuth corrections where incorrect magnetic declinations were used.
- Change of geologic unit designation
- Change of photograph number

The field books are primarily in chronological order beginning with 1 in 1980 and ending with 21 in 1982. Each book is indexed with a table of contents listing the areas investigated and page number. Field books are cross referenced where additional or similar data is recorded. A general summary of contents is as follows:

Field Book(s)	Field Season	Contents
1-5	Summer, 1980	Devil Canyon and Watana damsites and reservoirs, regional mapping; includes R&M notes
6-8	Winter, 1981	Devil Canyon and Watana damsites river mapping

FORM NO. 152 REV. 1

ACRES	Calculations SUBJECT:	JOB NUMBER FILE NUMBER SHEET 2 OF BY DATE APP DATE

9-16	Summer, 1981	Devil Canyon and Watana damsites, includes R&M Notes
17	Summer, 1981	Devil Canyon, R&M surveyor's Notes
18-21	Summer, 1982	Watana damsite area, and regional mapping

Outcrop stations are designated by ~~the following method~~:

W - 80 - 5

Damsite Year Outcrop

D - 81 - 50

Samples taken at an outcrop are given the same designation as the outcrop. Outcrop locations are shown on a series of maps and airphotos. The original airphotos with outcrop locations are stored in Anchorage. Copies of some of these airphotos are included with the field books. Maps showing outcrop locations, geologic data and geologic interpretations are stored in the following map tubes:

Map Tube	Contents
K 1	Watana Downstream Portal Area
K2	Watana Upstream Portal Area

FORM NO. 152 REV. 1

ACRES

Calculations

SUBJECT:

JOB NUMBER
FILE NUMBER
SHEET 3 OF
BY DATE
APP DATE

K 3 Watana Damsite

K 4 Foglakos Area

K 5 Watana Regional

— Devil Canyon Damsite

Rock hand samples are stored in Boxes K1 and K2. Photographs are stored in Box K3.

FORM NO. 152 REV. 1

P5701.05

AAI WATANA B #1
H.P. BRUEN

TABLE OF CONTENTS

WATANA DAM SITE - 24-28, 53-59, 94-115
SUSITNA UPSTREAM - 56-57, 70-71, 90-93, 131
SUSITNA DOWNSTREAM - 76-82, 84-90 145-147
QUARRY 'A' - 116-129, 130, 132-144
FOG CREEK - 60-64
DEADMAN CREEK - 65-69
TSUSENA CREEK - 71-76

WCC Glacial TRIP 15-22
RECONNAISSANCE 35-51
DEVIL CANYON U.S.B.R. DRILL CORE 36-42

	ELEV.
DEVIL CANYON RESERVOIR	1450'
WATANA RESERVOIR	2200'
WATANA CAMP - base	2262'

5-18-80

HKLAND AIR - takes care of flights from Anchorage to Talkeetna

7:00

In Anchorage its raining hard.

11:00

Flew to Talkeetna but we were unable to continue on to camp as it is snowing and there is 4'6" of snow on the ground.

6-24-80

TES FIELD COORDINATOR
Ominalee Logsden

R&M DRILLING COORDINATOR
George Sandrock

Woodward-Clyde
Woody Savage - geophysicist
John Hopkins - "
Jim Agnew
Thompson - technician

COOK - Hans UNGER

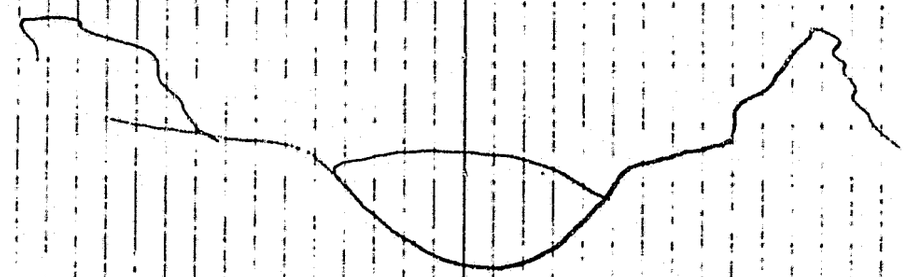
EKA PILOTS
Ken Rankin
Rick Harkness Ritch
Bill Wagner
George Nixson

3^00

Left Anchorage for Talkeetna on the Navajo, was only a 25 min flight. Upon arrival discussion with G Sandrock followed. After lunch, did a reconnaissance of Watana to Devil Canyon dam sites. Saw quite a few shear zones in the vicinity of both dam sites. Just downstream of Watana there was a mudslump on the left abutement. Bedrock exposures are few except near cliffs along the rivers edge.

Discussion w/ WCC will be soon as all their sites have already been chosen. Want to discuss one site with me.

Concern of some of the people in camp with the competence of Jim Haney.



Discussion with Woody Savage:
Appears that there is no problem in the sites that WCC selected. A couple of sites are near some lineaments but other than that there should be no problem.

11:5 PM

RITCH HARKNESS – ERA PILOT

1.) No communications w/ High Altitude at present
2.) Problems brewing between AKland and ERA. Special flights by AKland when ERA is available. AKland feels short-changed
3) Wasting flights to Talkeetna because of scheduling, between people coming into camp and those going out. Also how people get to Talkeetna depends on when to pick them up.

6-25-80

6:30

It's a beautiful morning.

7:0

Flew over to right abutement at Watana site near Corp trailer. Two photo's takes of a moose and her two calves just below me

B-1

Joint 75°-80° 68° S-SE to vert
outcrops have a heavy lichen cover. Hard to very hard rock

Joint 325°-340° 68° N-NE
Joint spacing 1" to 1 foot

Bedrock weathered surface is gray, black and in some small patches it is pink. Composition contains qtz feldspar, biotite and maybe hornblende?

Joint 40° and 75° E

North side of Corp trailer on streamlined form. Several small outcrops or boulders of diorite material with a 30-40 % CI. Few mafic minerals, no potash feldspar. This rock appears massive and is coarse grained.

B-2

Joint set 340° at 57° E
spacing of 6" - 2 feet
also 335° 65° E
This outcrop is in diorite

9:30

After checking a few outcrops, find that the area bedrock is composed of a diorite/granite. The texture varies from medium to coarse grained. Where lichen and moss cover is lacking the weathered surface is gray and a buff white.

B-3

Exposure at dump site. - next to fuel bladder boulders in a silty sand, pretty rounded, some striations can be seen. Boulders mostly composed of diorite. Boulders are rounded to elongate with some having very smooth polished surfaces. The high percentage of the sand matrix, the roundness of the pebbles - cobbles, and the general lack of striations indicates that this is probably outwash. Have to see more of surficial deposits to be sure.

Notes:

Vegetation mapping is being done by several people from in Palmer. Will eventually produce a map at a scale of 1:63,360

On communications, the Trident system is working fairly well, whereas the Oakland-Watana communications are out because the repeater is out.

10 30

Helicopter just arrived and Larry Acomb should be here.

At one location on right abutment, found a fine-grained, dark gray colored rock - quartzitic? - or fine grained igneous rock?

Weathering of outcrops in the area is extensive. Weathering often produces a rind.

Items to Purchase:

1) Plenty of Cutters
2) Film
3) Backpack
4) pick or shovel
5) shampoo and shaving cream
6) fold hand lense
7) aerial photographs
8) Bring books, POS, maps, some office supplies.
9) flagging tape

(Right) abutment w/ Larry
- just west of Corp trailer on same ridge

B-4 Joint 335° 75° NE
Diorite iron stained, lichen covered. Hard durable rock
Joint spacing 6" to 18"

Joints 0° 68°-70° E
spacing of 6" - 1 foot

Joint - fracture 310°-315°
vertical wide opening

DEVIL CANYON SITE

Outcrop of phyllite – alternating layers of slate & graywacke – pronounced foliation – oxidized hard rk.

Very few exposures; only those that climbers will get to

Joints 325°, 330° 315° vert. spacing is a couple of feet

handed on left abutement; Can't land near cliff on right abutement

In places it looks like a phyllite but I've seen mostly slate

Joint 350° vert.

Outcrops – when a fresh surface is obtained, get fine grained black metamorphosed rock

The small pond south of Devil Canyon has few exposures at its perimeter. On the north side of the pond there is a large outcrop of slate/phyllite.

Cottage at Devil Canyon
~ 60 boxes of ~ 10 foot each,
core boxes,
Wooden core boxes

Right abutement – air reconnaissance generally no exposures or places to land!!

Notes:

1) Most talus slopes in D.C. reservoir are old. Heavy lichen & vegetation cover. Few fresh outcrops.

2.) In box of Susitna (east end, Fog Creek vicinity). Visible slide/slump on left abutement. Check for pf. Faces NW?

7-8-80

Flew into Stephan Lake @ 6:30. After dinner, a general discussion followed with Stu, Bob, Peter, and Larry.

General concensus:

1.) Devil Canyon site may not be the optimum site problems: faulting, shear zones and of removal of bedrock slopes.

2.) Mapping around dam sites should be of sufficient area in case dam sites have to be shifted

3.) Borrow sites E and D. Areal extent needs to be delineated before auger drilling and test pitting begins, especially at E.

4.) Quarry sites: "B" - Seismic lines approx N-S at Borrow site "D" indicate that "B" may be unconsolidated mat'l. "A" - sufficient areal extent needs to be defined before drill holes are chosen. Get rock quality data

5.) Powerhouse on south abutement at Watana. Problem may be completely underlain by pf. Expect changes in location & designs of spillway & powerhouse @ Watana

Stephan Lake crew
Jim

7-9-80

6:00

Overcast and rainy.

Map I-415 Map Showing Extent of Glaciations in Alaska several authors

Trip w/ Norm Ten Brink. Trip involved - flying to Butte Lake (W side), head of Nenana rear glacier (E facing slope), Amphitheature Mtns - around Denali highway, flew back Coal to Jay Creek, then along reservoir, and then to North Tributary of Fog Creek.

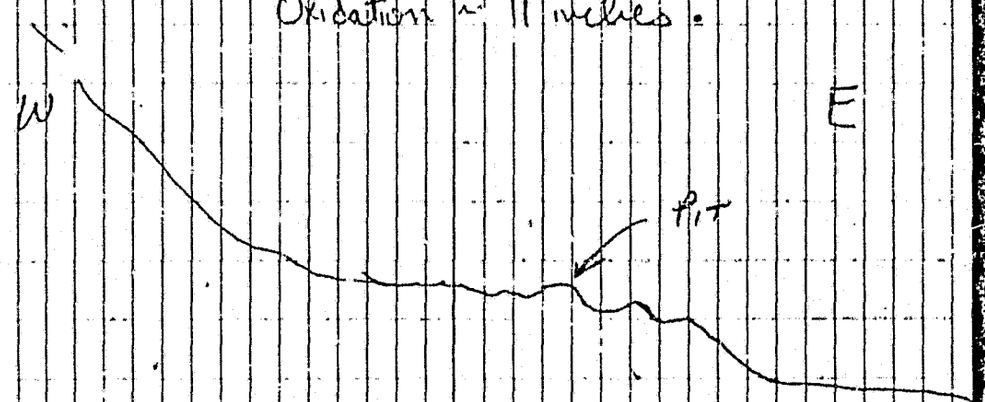
STOP 1 Butte Lake
Early Wis ~ 4000'

morainal deposit - subdued
crest broad crest
degree of hummockyness is
low, slope angles

- believes Early Wis was
higher than Late Wis

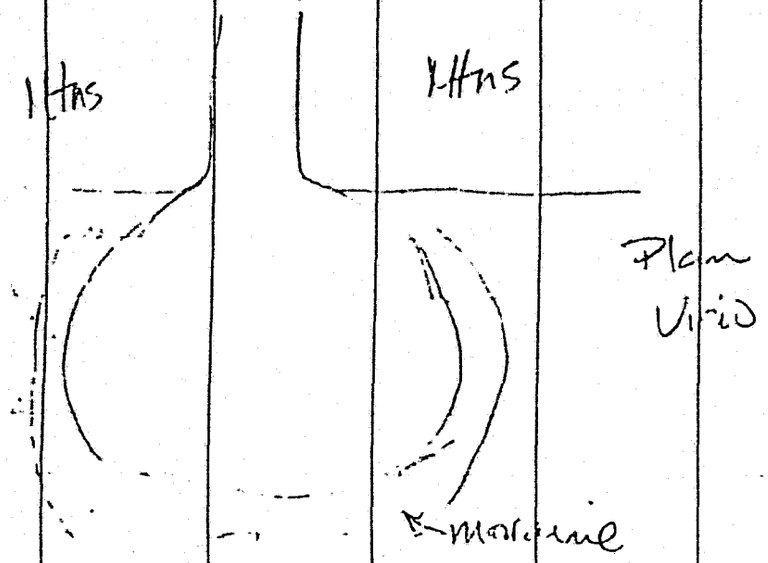
Late Wisconsin ~ 3600'

TOP 2 Near Nenana Glacier snout
Lateral moraines of 9,500 - 10,000
High boulder concentrations
Granite boulders have disintegrated
to qtz & feldspar grains
(4 pix)
- Excavation of a pit in this
lateral moraine. Very sandy
(medium) gravel till.
Gravelly, med gr sand (till)
Oxidation ~ 11 inches.



For oxidation - go by light &
dark minerals - more reliable

Stop 3 Amphitheature Mts
2 pix
(a) Oxidation ~47cm



- subdued moraine, few boulders are exposed at the surface
- resembles early Wis but can't find it late Wis
- metavolcanic boulders in silty sand

(b) Out at main valley several levels of lateral moraine all of late Wis on the east facing slope. Pictures of ice disintegration features in valley (2)

Till has a little more silt to it gravelly silty sand

STOP 4 North Tributary of Fox Creek

Excellent kame delta and esker just upstream of mouth. Kame delta has numerous well formed sinkholes. Also lateral moraine ridges on valley sides. Three levels with marginal channels still evident. Lower two levels are late Wisconsin, upper is late Wisconsin or early Wisconsin. Incised Creek through the kame delta - why? Fracture zone, fault, etc.?

Needs:
Mylar 4-5 mil
Stabilo - Pen 96P
Overhead - Projection

7^00

Jim Haney arrived at High Lake.
No helicoptor for us today.

Arrived at BH-6 at 11^45

Final depth of BH-6 is 740.4'
at approx. 60°
Core is being stored in plywood
shack next to Corr Trailer

Depth 707.2' - 717.1'
CI = 10-15%
Qtz. diorite - qtz., biotite
some trace of epidote
rehealed joints

Janice Hagan
Rick

Diorite to granite
loss of some mafics, epidote
in core ~650' to bottom
weathering in joints to 175' along
drill hole

Traverse from BH-6 to BH-2

W-10-1 sample
Joints
320° 12° SW
350° 40 E
70° Vert
weathered surface

W-10-2
200' @ 2^15

W-10-3

Joints

285° 85° N

30° 82° E

17° 80° W

heavily jointed, pitted weathering heavily weathered fracture zone

2071' 2 40

W-10-4

Joints

117° 75° N-NE

348° 55° NE possible shift movement, shift upsure pitted surface

350° 54° NE

302° 37° S

pcs 1 to 2" ice

10° 87° W

1990' 2 15

BH-2

1940' 3 15

W-10-5 ~ 700' W of BH-2

295° 83° W

345° 75° E

Across from fins on left abutement

340° 85° SW

Granodiorite

Back at BH-6

1748' @ 5 15

1758 @ 6 30

Stephan Lake

1933 at 7 30

Comments on traverse between BH-6 and BH-2.

1) Below the Shannon & Wilson seismic line, that flows the contours, little to no overburden. Good rock exposures. Determine how far upslope this occurs

2) Just 200' East of BH-2 gradational contact granodiorite / sort of andesite basalt porphyry. No shears were found. Walked a little west of BH-2 and didn't go back into Dioritic material. Contact drawn by Core appears accurate

Notify Bob & Jim
1) draftsman
2.) room space & an office
3.) acetate
4.) drafting pens (2)
5.) ruler, scissors, scotch tape

Each Site

Bedrock*
a) lithology (on map: plutonic rk., andesite, shale etc.
b) orientation of joints (sample if necessary)
- weathering
- spacing
- indication of movement
c) strike & dip of rock if possible
d) overburden thickness if applicable
e) extent of outcrop - use for surficial map

Unconsolidated material*
a.) type ie ground mor., outwash, lateral moraine, alluvium, talus, etc.
b) estimate thickness where possible.
c.) depth of oxidation
d.) description of type: grain size, roundness of boulders, cobbles, etc; striations

* Samples taken where applicable.

Watana

Unconsolidated:

- Till - ground moraine
- Outwash
- Alluvium

Bedrock

- Plutonic - diorite, granodiorite, qtz. diorite & possibly granite
- Volcanic - andesine basalt
- Shale / slate
- Graywacke argillite

Devil Canyon

Unconsolidated:

- Till - ground moraine
- Outwash
- Alluvium

Bedrock

- Phyllite (includes slate &.

Stu:

1) Will speak w/ Haney & Gill about room in Watana and office space
2) Letter to R&M: aerial photo analysis (existing at 1"=2500') interpretation of pf, landslide potential, and etc.

7/11/80

Overcast, lowclouds and raining hard. Don't know if the Akland ship can get in from Talkeetna

Stephan Lake 1862'

1862 @ 10⁴⁰ @ 51°

Helicopter arrived at 11⁰⁰.

STOP 1

Traverse from DH-28 to DP-12, 23, on left abutement. - no outcrops visible. Proceeded to walk from DH-12 upslope to Quarry area. Found a few outcrops of porphyritic andesite (sampled). Walking west parallel to contours, went from andesite into plutonic rock (granodiorite or qtz diorite) pic of BH-6

Flying:

Flew along Susitna, (~15' above) Going west, went through the dioritic material, into the andesite, then later went through sedimentary rocks that were thinly bedded, into ice-contact (outwash looking material), then back into sedimentary rock near Tsusena Creek. maybe two pix

Flew up Tsusena Creek. Saw heavily fractured zone, orange stain on SE facing slope (maybe shear) appears the bedrock is andesite, but check. Further upstream saw thick till exposures. 2-3 pix landslide falls

Flew up Deadman Creek, thick exposures of till, Appears that from water fall → downth, incised stream walley, may be new mouth of Deadman Creek post-glacial several pix landslide?, till, falls?

later one of Quarry site A

Notes:

1.) Did not see clearing for BH-8
Need to determine its position near the andesite / diorite ck contact?

2.) Initial mapping to be from helocopter... Followed up by mapping on foot & using R&M's boat.

7-12-80

Pick up at Stephan Lake @ 9:00
Proceeded to fly along Susitna to Devil Canyon. General fly over of the site. # pix

Stop 1
Left abutement walked to bunkhouse. Core boxes are open and some are on the floor. Inventory conducted of these boxes, see following pages. Bedrock is argillite not a phyllite.

STOP 2. Traverse over to between the two lakes. Jon Lovegreen believes that there may be a problem here. There is one pit and trench (?) cut in here. Then traversed to cliff and the along edge back to the dam axis.

Go to p. 43

Junk house Inventory

Borehole 9

Box		
1	0	- 21.0'
2	21.0'	40.0
3	40.0'	- 59.0'
4	59.0'	- 79.0'
5	79.0'	- 87.0'

Borehole 9

1	0 -	21.0
2	21.0 -	39.0
3	39' -	58.0
4	58	- 77
5	77	-- 96
6	96'	- 115
7	115.0	- 134
8	134.0	- 150'

Borehole 10

Box	Feet
1	0 - 21.0
2	21.0' - 39.0'
3	39.0' - 58.0'
4	58.0 72.0
5	77.0 - 96.0'
6	96.0' - 116.0'
7	116.0' →

Borehole 11

1	0 - 24.0'
2	24.0 - 24.5'

Borehole 11c

1	0 - 24.9'
2	24.9' - 47.8'
3	none
4	52.0' - 77.0'
5	77.0' - 101.0'
6	101.0' - 125.0'
7	125.0 - 150.1'

Borehole 14B 11

1	8 - 24.6'
2	
3	47.2' - 70.5'
4	70.5' - 93.3'
5	93.3' - 118.1'
6	
7	- 146.2'
8	
9	
10	

Borehole 12

1	0 - 25.3'
2	25.3' - 50.0
3	hole
4	75.7' - 98.1'
5	98.1' - 122.4'

Borehole 14

Box	
1	8' - 24.6'
2	24.6' - 50.8'

Borehole 12A

1	0 - 25.0'
2	25.0' - 50.0'
3	50.0' - 73.0'
4	73.0' - 98.0'
5	98.0 - 121.0'
6	121.0' - 145.0'

Borehole 13

Box	
1	none
2	24.8' - 50.5'
3	50.5' - 77.4'
4	77.4' - 114.6'
5	114.6' - 137.0

Borehole 13 A

1	0 - 25.3'
2	25.3' - 49.7'
3	49.7' - 80.7'

Borehole 4

1	0 - 39.0
2	39.0' - 52.5

Borehole 11 A

1	0 - 21.0'
2	21.0' - 29.0'
3	50.3' - 56.7'

Borehole 11 B

1	0 - 5.0'
2	5.0 - 33.9'

Borehole 1

1	0 - 21.0'
2	21.0 - 38.0'
3	38.0' - 58.0'
4	58.0' - 77.0'
5	77.0 - 96.0'
6	96.0 →

Borehole 7

1	0 - 50.0'
2	50.0 - 59.5'

Borehole 6

1	0.0 - 90.0'
2	90.0' - 107.3'

Borehole 5

1	0 - 77.0'
2	77.0' - 86.0'

Borehole 15

1	0 - 67.0

UNK = 9

82 total boxes.

Flew to the west along the canyon ~ 50' above the river taking pictures of the right abutment. (~ 31 pictures) Most are overlapping but there are at least three gaps because of lack of exposure. Roll #2

Stop 3

Landed on BH-2. Will change this one to N 45°-50°E at 55°-60°. Draw a x-section.

Stop 4

Tried landing at BH-1, couldn't. Would like to change this hole. Move it out ~ 150'-200' east, Drill ~45°-50° W at ≈60°, depending on slope

Returned to Watana. Talked with George Sandock about potential changes in the drilling program at Watana & Devil Canyon, also

asked George to have someone repair the core boxes in the bunkhouse and remark them. Will need to clear a spot next to the bunkhouse to sling the core boxes out. George informed us of CME-45 that had arrived.

Flew over B4-8 at Watana and think it may have to be moved. Then flew over Borrow site E and then up creek north of Fog Creek where sedimentary Rocks are exposed.

Devil Canyon notes:
Large slide blocks possible
Dikes or weathered zones - appear orange in color.

7-13-80

Today it is cloudy, but at least isn't raining. We plan on flying both reservoirs (i.e. Susitna tributary's
Map symbols
● STOP
A See notes on following pages
→ Flight lines

Flew to just downstream of Devil Canyon and began flying upstream.

Portage Creek - good rk exposures ag, dikes - similar to D.C.
Cherchako Creek - can't get to most exposures, change in rk type ??
South tributary opposite High Lake - good exposures of the biotite granodiorite TBGD, STOP 1
A = lots of lineaments, changes

in stream course. Sampled

Then flew west to the Tertiary volcanic's exposure Tv. Rounded knobs for mountains, few exposures

STOP 2. Sampled

* see page 51

Flew up Devil Creek

STOP 3 TSMg in the Susitna River box, north of the river. Variations in the rock for comparison at Watana. Dioritic material can be fine grained here unlike that at Watana. Sampled

Flew up unnamed creeks north & south along the box.

Flew up Fog Creek. Alot is happening here, including possible shearing and/or faulting. Complex geology. If Talkeetna thrust exists, the exposures here should reveal what has happened. Important field check.

Go to page 48

U-2 Photo's

19-84 ✓19-81→90

19-81 ~~19-176-182~~

19-82

16-178

16-179

NASA JSC 364 July 1977

16-177

16-178

16-179 ✓16 177-183

16-180

16-181

✓ 16-160-150

✓ 16-238-245

ORDER:

U-2 Photos - NASA JSC 364 July 1977

19-81 through 90

16-150 " 160

16-177 " 183

16-238 " 245

N of Bull Lake

19-70-76

Flew up creek north of Boxcar site E. Like Fog Creek the geology is complex. Important for Field mapping.

Flew up Tsusena Creek. This needs to be mapped as it is complex and it will aid in determining the structure at Watana. Crossed over to Tsusena Creek and came down Deadman Creek

Exposures only in lower reaches of Deadman Creek. Can see till exposures. Rock exposures only at the mouth. Has a waterfall. Think I took a picture.

Flew up unamed creek just west of Watana Creek. Extremely bad slumps, mostly on east facing slopes. Took some pictures of this

4.

Flew up Watana Creek, very unstable slopes, lots of recent and old slumps. Appears that the lake clay(?) or at least fine grained unconsolidated sediments. This will be a major problem area in the reservoir. Slumps are visible on both slopes.

Flying upstream from Watana Creek. Lateral moraine on the south side of the river @ ~1900' and can be traced upstream quite a ways to ~2700' elevation. On the south facing slopes, there are slumps, this is the worst area for active slumps on the Susitna itself

Flew up mouth of Kosina Creek, flew exposures other than at mouth

Flew up Jay Creek, then up the Susitna to Clarence Creek,

Then flew along Susitna through "Vee Canyon" (?). Excellent rock exposures on right abutement but lack of bedrock on left abutement.

Continued to fly up Susitna to junction with Oshetna River. Will have no problem w/ reservoir from jct. w/ Goose Creek and upstream.

Notes:

1) No problem w/ surficial slope failures on Devil Canyon reservoir. Possible w/ the bedrock.
2) Numerous slumps in Watana reservoir, will have many problems w/ unconsolidated slope failures, especially in Watana Creek area.
3) Looked at varying rock types in Devil Canyon reservoir
4) Need to make spot checks on the bedrock in the Watana reservoir. Slope failures here will be a problem mainly in the unconsolidated sediments.

Rock types not checked

Jam - amphibolite plus green schist and foliated diorite
TRv - basaltic metavolcanics
Pzv - basaltic to andesitic metavolcanogenic rocks
TK gr - granitic rks, undivided

Con't from pg 46
after seeing the Tv, flew west to Gold Creek to look at the structurally folded argillite; Kag

7-14-80

Arrived at Watana @ ~ 9:00.

CALL ANCHORAGE

1.) Talk to Bob about the list of supplies and U-Z photo's
plates
b+W photo's

2.) Hugh - need someone to pick-up everyone at Alland in the P.M.
- call Linda + L. Acomb. wife, Sandy
277-4149

Fri { Peter ANC - Toronto
Stu ANC - Syracuse

10:00 - 11:30

Discussion with Keib, Stu, Peter, Larry and myself.

12:00

Had lunch and then proceeded to look at core from BH-6, Watana. Some variation within the core but not much. Relatively good core with little weathering, mainly along joints. Some clay gouge.

W-10-6

Outcrop opposite CORP TRAILER

Variation of diorite to qtz diorite

	45°	64° SE
1) ✓	50°	85° SE
	55°	80° SE
2.) ✓	340°	72° E
	320°	85° E

no well defined spacing of joints

10-10-7

porphyritic andesite
Peter's

Joints

✓ 3 @ 2° - 350° 64° - 77° E
2'-6' spacing
✓ 62° - 68° 76° - 90° SE
45° 72° SE
300° 32° NE

Joints seem to be in pattern
defined to N-NW & NE

1-15-80

Set altimeter w/ Stephan Lake
1862' @ 63°
@ 8 40

10 30

Helicopter picked me up at
Stephan Lake

1.) reservations for 3
2.) ~~set~~

who gets priority

Larry can take Peter &
Leib over to the cove

Brozan is sending lineament maps & microseismograph station maps

today

W-15-1 12⁰⁰

Dropped off at Corp Trailer South 190'-195' to diorite outcrop 2385' @ 60° @ 1²⁵

W-15-2

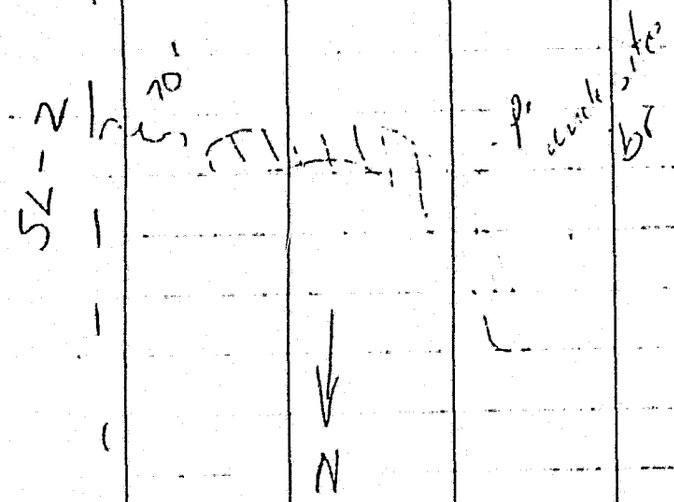
East of Seismic line 60' outcrop of porphyritic andesite

W-15-3 p. andesite outcrop 2243' @ 1⁵⁶ @ 60° just west of seismic line two ~10' west just below tree line

Joints:

283°	82° N	spacing ~18" to 3'
288°	83° S	
288°	75° N	
340°	64° W	18" spacing
338°	74 SW	
305°	18° N-NE	~2.5' spacing
340°	10° N	
297°	74° NE	
2°	83° W	
12°	43° W	
215°	87° N	5'
288°	88° N	

Plan view



W-15-W

135' east of Vismis line-2
outcrop of diorite
elev. 2080' @ 248 @ 60°

Trends: 0° 86° W
355° 87 W @
≥10' poorly dated
70° 72° SE
330° 72° E-NE

7-21-80

Arrived at Watana @ 10^00

Elev. 2300' @ 10^15 73°

W-21-13
co. grained rk andesine or gabbro ?? took sample

elevation
2999' @ 11^14 @ 70°
by the X

Fog Ck stops
W-21-2
argillite, heavily oxidized

90° 61°N

72° 38°N

318° 75°S Joint

W-21-3
Qtz diorite or diorite
biotite rich

Joints

	90°	70° N	2' to
	335°	85° W	18" - 5'
	340°	83° W	
	340°	84° W	
along	0°	85° W	~1' - 6'
	80°	53° N	~1' - 6'
	60°	26° S	2' - 6'

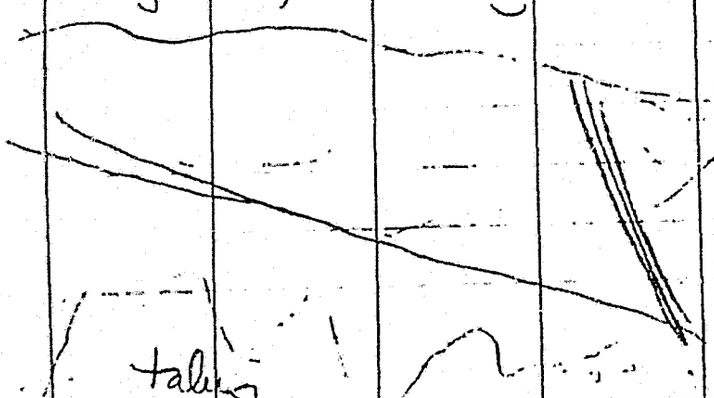
noticed change in weathering
color yellow orange to gray

W-24-4
arg Clite - slate
35° 75° W bedding
310° 85° N
4" → 8"

Lunch 12 - 1

W-21-5
Qtz diorite on left abutment
Joint 90° 63° N

landed on left abutment, better exposures on right abutment blocky rock; weathering and talus



slopes resemble argillite though uncertain as to what is going on here. Appears that there has been some thrust faulting.

Appears to be all diorite. Check w/ WCC on possible faulting here. Elev. 2120' helo.

W-21-6 N. Trib. of Fog Ck.

Purplish weathered rock, appears to have horiz. structure from the air (color). Appears to have a glassy texture like tuff(?) Some scoria in the tuff like material. Didn't see any ~~chan~~ contact. Covered by a couple of feet of till very rounded.

D

W 21-7

Edge of stream - outwash
exposed, stratified deposit
sandy gravel - silty sand

top has sandy gravel w/
cobbles & boulders
reworked outwash probably
elevation ~ 24[illegible]'
outwash is > 100'

W-21-8

~ horizontal layered rock
shaley to possibly ~~graywacke~~ siltstone
where it's parting it appears
coarses

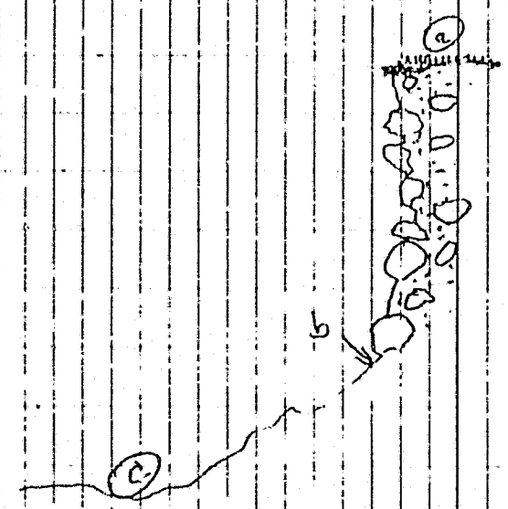
S+D 70° 5° N-NW

Helicopter dropped us at mouth
of Deadman Creek on right abutment

W-21-9

elev. (a) 2253' @ 3.45 @ 77°
Outwash bluff
near Auger Hole 8
elev (b) 2193' @ 3.59 @ 77°

bouldery outwash, in a
coarse grained matrix
30°-40% cobbles and boulders
some small fine-med gr sand
lenses



(c) 2137' 4.20 (a) 77°

Diorite, co. gr. m bench just below
Joint 11° 10° W
350° vert.

Bedrock on left abutement is mainly blocky but resembles that seen at W-21-8

Altimeter at Watana
2280' @ 72° @ 7[00]

Saw a lot of variety today. Will try to finish up Watana dam site reconnaisse this week followed by traversing.

13 hours

7-22-80

It's another beautiful day. Sunny with a 15% cloud cover.

Watana Camp
Elevation set: 2300' @ 8[15]
@ 68°

Planned the day to make stops along Deadman Creek, and then along the Susitna between Deadman and the Fins and stops along Tsusena Creek

W-22-1
Biotite rich diorite blocky
Can't get any joint measurements here

22-2 3421' @ 9:30 @ 72°
thick oxidized zone 12"-13"

pebbly fine sand, all pebbles are rounded, little to no silt

W-22-3

2323' top @ 9:35
bluff exposure along Dandiman

well rounded pebbles and cobbles in a fine gr and co-gr sand

some talus slopes (small) on opp abutment & halfway up the slope, no outcrop exposures
slg on top exposed as bluff

boulders - diorite, argillite, metavolcanics, gneiss
slg seem to be exposed down to stream level

stratified deposit, sand is well rounded

W-22-4 shaly to low grade schist
40° 62° NW thinly bedded 1/4" - 4"
42° 64° NW

Joint
2° 25° E 4" - 18"

W-22-5 phyllite (?)
45° E 27° NW bedding
353° 81° E joint
6" min to 1'
350° 85° SW
this outcrop is the same as 22-4
talus is platy material

landed at ~2200' - outcrop @ ~2140' facing east

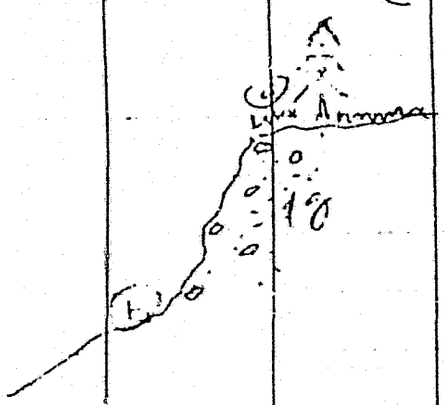
W-22-6

2256' @ 72° @ 11:00

Landed near DH-30, walked west to the exposure

- Sand & gravel, not as many boulders here as elsewhere sand layers range from a med to coarse sand to a silty sand (no plasticity)
- deposit is stratified
- all boulders - no sharp edges, they are rounded

2203' @ 72° at 11:00



Lunch 12 - 12:30

Saddle opp the Fins

W-22-

porphoritic rk Calc. plagioclase w/ sodic plag phenocrysts possible altered andesite

Joints

303° 88° SW

292° vert

- unsure about how? Corp mapped this as diorite.

Stops ~~from~~ along Tsusena Creek all the way to Borrow Site "F"

W-22-8 Tsusena Creek

Appears to be some sort of xtalline landmass Ranges from fine grained steel gray to a light green color. Appears that there may be some slickensides(?)

Joints:

292° 64° S 2-3'

20° 40° NW

This was the first major outcrop [illegible] when flying up Tsusena Ck

W-22-9

beginning from here, a deeply incised gorge w/ bedrock cliffs. High degree of jointing. Diorite is the bedrock. Can't get to any joint measurements. Thin to no overburden at the cliffs

W-22-10

Slump exposure of till

bouldery sandy silty till, very compact, lodgement till, ~~mostly~~ generally rounded boulders no sharp corners, some elongate

gray-green when wet

buff-tan when dried

- holds a vertical face
- 10%-15% boulders and cobbles

this is near Borrow site F

at least 25' thickness, that's what's visible.

W-22-11

Co grained dioritic rock, hornblende or pyroxene rich diorite, Massive

Joints

355°	63° W	
260°	77° S	} 3' spacing
270°	80° S	

W-22-12

med. to co. gr. sand some boulders. terrace deposits, good pervious mat'l source - Borrow site F

This borrow site is for material from the stream terraces (probably outwash)

Dropped off at mouth of Tsusena Creek at the small depression between the Susitna & Tsusena Ck.

W-22-13

Exposure of a homogeneous silty sand, moist, loose, semi stratified. Cobbles & boulders can be seen on the slope but none was observed in the hole dug. If there

If there are no boulders, how [illegible] the proposed kettles form
1677' @ 4:30 @ 77°

- Varies w/ some cobbles, also matrix ranges from a fine-med gr sand to a silty sand or sandy silt w/ low plasticity
- no definite pattern & thus explanation for were the today (boulder sand) sections are

Depressions have steep sides

W-22-14

Orthoquartzitic? Variation w/ this unit, med gray fine grained to light grn-buff (arkose looking) rock. Uncertain as to the rock type

Joints

bedding? 37°	22°	NW	2' spacing
316°	84°	NE	3" - 1½ ft
285°	81°	S	≥ 6"
90°	86°	S	
312°	87°	S	
310°	88°	S	6" - 3"

This outcrop when observed from the helo, appears to have well defined bedding. More investigation needed here to determine what we have.

Watana
2397' @ 8:15 68°

11 hours

lev

7-23-80

It's a beautiful crystal clear day. Will be dropped off near the outcrop near the mouth of Tsuesena Creek, but along the Susitna. R. abutment

Altimeter set at Watana 2300'

@ 7⁵⁵ @ 63°

W. 80-50 (Switch to new numbering system along Susitna base of cliff

grayish white fine gr sandstone or siltstone

350° 11° W bedding

= thinly bedded

Joints:

318°	86° NE	3" - 3'
335°	86° SW	
52°	73° SE	
332°	77°	3" - 1½'
33°	70° SE	

(b) S&D's

42°	16° NW
35°	11° NW

Joints: 61° 80° S

86° 21° N 1'

Re sandstone outcrops in at least the bottom 40' of this cliff. On the talus slopes beneath the cliffs rks. range from: sandstone, shale, siltstone(?), conglomerate and possibly a gabbro and tuff(?) These should outcrop above but we can't get to them. Uncertain about some of these rk types.

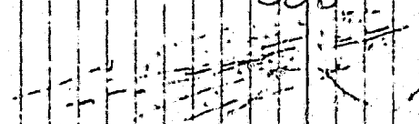
Strike west end of outcrop

@ 5° 15° W

sandstone w/ some thin layers of a pale green (buff) shale

Joints

285°	vert	6" - 1'
308°	74° NE	3" - 2'



X-SECT

W-80-51

uptop on this outcrop, gabbro appearance

Joints.

328°	85° NE	1' - 3'
356°	68° W	2" - 2'
70°	76° SE	≥ 2'

Elev. 1718' @ 10^{35} @ 75°

W-80-52

greenish rock, seems to have alot of calc plagioclase andesite?

outcrop on east edge of large outcrop just downstream of the sand & gravel cliff. located ~70' above the Susitna

W-80-...

Have a variety of rk types, the tuff or conglomerate like material, a buff fine gr sandstone interlayered w/a dk gray siltstone

Strike 30° 31° NW of sedimentary unit

Joints:

331° 79° NE - 81° W
25'-3' spacing

B 16° 76° SE spacing 3'-1'
57° 86° S-SE ? > 3'-4'?

Just west of here is a dark gray igneous looking rock
Sampled

W-80-54 main graywacke?

Gray orthoquartzitic rock;
315° 84° N-NE ≥ 2' spacing

W-80-55

Buff green (pale) sandstone & probably conglomeratic sandstone (pebbly sandstone) - Corps graywacke
Elev. 1562' @ 1^{18} @ 71°

Strike or joint
260° 5° N

Joints
65°-70° 88° S 1'-3'
320° 65° E ?

W 80-56

med gr. green andesite or andesitic basalt

elev. 1841' @ 1.40 @ 78°

Joints 320° 75° NE 1'-4'
305° 85° NE

W-80-57

Elev. 1888' @ 2.10 @ 79°

appear to have andesite above a fine gr. green sandstone

Joints

~~307° 89°~~

320° 89° S 18'-2'

308° 89° S

316° 80° S

65° 78° S-SE 3'

325° 79° NE

Bedding (?)

~ 5°-10° 24° W

318° 32° SW

W-80-58

1906' @ 2.55 79°

think we came down 20'-30'; not up

fine gr. grayish white sandstone on edge of cliff

W-80-59 at edge of cliff

2030' @ 3.30 @ 78°

appears to be the sandstone, grayish white but Larry found a gray _____ (sandstone)?

W 8[illegible]
[illegible] andesite next
to [illegible] line

F[illegible] [illegible] @ 4[illegible] at 80°

W-8D-61
Just 100' east of seismic line
Outcrop ridge
andesite looking rock

Watana
[illegible] 2308' @ 6[illegible] @ 7[illegible]°

Summary:
several different lithologies were
seen today.
Sedimentary complex:
sandstone - seems to predominate, a
gray-white fine to med gr rock
tuffaceous conglomerate - a green
fine to medium grained ground-
mass w/ pebbles that are
rounded to angular.

siltstone to shale - gray very fine grained
rock and a yellow and dark gray
fine grained rock.
gabbro - dark gray, med to coarse
grained, high C.I.
don't remember where this was
found on ridge just west of
the Corp Trailer.

Just below the break in slope
there is ~~no~~ little to no overburden
In walking along the road between
the Corp Trailer and Watana Camp,
after the exposures on the ridge,
there are no rock outcrops to the camp.
Thus significant overburden but
can't determine the thickness

12 hrs

7-24-80

It is a mostly sunny day w/ some scattered clouds. Will be dropped off at BH-2, and work in that area after seeing the core.
Elev. 2300' @ 7^07 @ 65°

BH-2
Elev. 1887' @ 7^50 @ 64°
Drillers are at 175.8'. Have cemented the hole again. Won't get started until ~ 12^00
At 170.5-175.8', still in the green porphoritic andesite

~72' begins to get broken up
108'-115' almost continuous clay gouge
87.5'-97' broken up
148'-160' badly broken up
pulverized, clay gouge

- oxided joints to 175.8', some calcite along the joints

W-80-62
Porphoritic andesite
Joint 2° vert.
outcrop is fractured but can't get any other good trends

1976' 8^55 @ 65°

Joint
325° vert.
295° " 6"-2½'
284° 84°N 18"-2'
65° 87° NW 2'
large outcrop at least 100' across may continue

70° Vert
2° 60° E -2'
348° 25° N 2-4'
283° 41° S
325 86° NE 18"

60° 82° ± ~2'

U-80 63
at seismic line, south end 80-1
elev on marker
2054' @ 9^38 @ 66°
elevation taken on survey marker

So along the elevations given between BH-2 and the seismic line, we are still in the porphyritic andesite.
This location is at the top of a cliff just down from the break in slope

U-80-64
porphyritic andesite, massive

Joints
283° 74° S
3° 58° E
2° 58° E 4½'-6'
308° 81° 2'-3'

Elev. 2096' @ 9^58 @ 68°

U-80-65
porphyritic andesite

Joints
356° vert. ~4'
294° 87° S ~1'-3'
12° 24° W 2½'-3'
Elev 1723' @ 10^30 @ 67°

Flagged this outcrop

U-80-66
very small outcrop of sandstone just east of the talus slope covered by vegetation. The talus slope is flagged and the outcrop is ~175'-90'

to the east at approx the same elevation.

Elev. 1605' @ 11° @ 69°

To the west (downstream) the vegetated talus slopes continue slope ~ 34°. Talus is very regular w/ cobbles up to 1' across but mostly 4"-6" in a mud matrix. Composed of sandstone & the tuffaceous conglomerate

We are just at the upstream end of the island

Joints:

300°	86° S
40°	84° S
316°	83° S
35°	89° S
294°	51° S
310°	16° W N
bedding (?)	29° 39° E

LW-80-67

downstream end of large outcrop in the Susitna - porphyritic andesite

314°	86° NE	
350°	46° E	~2'
75°	58° N	~4'

Elev. 1552' @ 11° @ 69°

proceed down to edge of Susitna

LW-80-68

Elev. 1502' @ 12° @ 68°

large outcrop

- looks like the porphyritic andesite except that it has a dark gray groundmass instead of green

sampled this

303°	68° NE	
324°	78° N	~2'-4'
272°	17° S	
74°	84° S	

In continuing to walk upstream, crossed a talus cobble zone w/ boulders up to 2'-3' in diam w/ a heavy lichen cover. Also still find that we are in the porphyritic andesite

BH-2 1879' @ 1.00
@ 69°
same reading @ 1.45

W-80-69
Elev 1925' @ 2.00 @ 69°
From BH-2 to this point at approx this elevation, there is an outcrop exposure that stretches for some distance. It is all still andesite w/ some texture changes.
Early @ a higher elevation we found diorite much closer to BH-2

Joints:

	297°	86° N	3'-4'
	77°	40° S	~1'
same set ?!	356°	86° W	~1'-2'
	16°	87° W	2'-3'

W-80-70
Change from the andesite to a calc. plagioclase rich diorite (?)
~~130° west of~~
It has a med. grained texture. Sampled.

~~130~~ Elev. 1935' @ 2.30 @ 73°

W-80-71
Elev. 1951' @ 2.43 @ 70°
Dioritic material w/ a fair amt. of calc. plagioclase. Flagged and sampled this point. Change in rk. type occurred approx 160-170' west of here at 80-70

Joints:

290°	88°	S to ~85°N
12°	79°	E ~6"-3'

massive outcrop

338°	35°	NE

W-80-72 exposed along river

Diorite / granodiorite, med. gr.

calc. plagioclase

Joints

55°	86° SE	~2'-3'
345°	75° NE	~2'-5'
73°	41° N	~6-7'
40°	87° NE	

W-80-73

on right abutment right across from the Corps DH-21 there is a very high cliff with no beach. This isn't evident on the air photos,

Watana

Elev. 2312' @ 6.00 @ 65°

Today our traverse took us from BH-2 west along & above the bedrock cliff until we reached the sandstone and then we went down to the Susitna, on the bank and walked back through the andesite to BH-2. After lunch we proceeded to walk east at approx the same elevation as the drill rig until we reached the andesite diorite contact. At this elevation, it was much farther east that what we determined approx. 2 weeks ago. After finding this contact (change) we dropped down to the base of the Susitna and followed it upstream until we ran out of beach, i.e. reached a cliff.

13 hrs

7 25-80

Cloudy and overcast looks like rain. Worked on right abutment traverse from centerline to the "Fins".

Watana

2300' @ 6 50 @ 63°

W 80-14

co. gr.

andesite - some abbro looking

Elev 2241' @ 7 13 @ 56°

temp @ 6 50 may have been 56°

thin veg covering

- probably the gradational contact between the diorite and andesite, Green. co. grained w/ biotite as in the diorite or granodiorite

W-80-15

large outcrop of andesite

Elev 2200' @ 8 35 @ 55°

Joints:

73°-77°	84° S	1'-4'
355°	15° W	
315°	75° NE	
275°	78° SW	3'
115°	13° N	6"-3'

just finished walking west of the Corps trailer for quite some distance looking for any outcrops but none were seen. Walked to just past the control point and then looped downslope and back to the Corp trailer

9 50

Stopped @ BH-2, they are down to 225.7' the core is much better. Med to co-grained rock

W 80 16

W-80-16
Diorite exposure just upstream of BH-6 and the HeCo pad
Elev. 1692' @ 62° @ 10:40

Joints:

305°	76° SW	3'
317°	42° NE	2'-4'
60°	44° S	2+'

W 80-17
at the downstream end of the beach closest to the BH-6 but upstream side of cliff

Med to co gr quartz diorite

Joints.

5°	72° E	
54°	76° NW	
15°	73° E	min 15"
270°	75° N	1'+3'+
275°	75° N	
337°	20° NE	8"-2'

W-80-18
Diorite outcrop along the Sunitna just upstream of the seismic line

Joints:

35°	76° SE	
310°	80° S-W	2'-4'
10°	4° W	
5°	45° E	
42°	86° NW	
20°	45° W	2'
310°	83° S-SW	
350°	40° E	
340°	14° E	3'
338°	85° NE	2.5'

[illegible] started [illegible] single [illegible]
[illegible] 19
diorite or quartz diorite outcrop

Elev. 1618' @ 12^22 @ 62°

Joints

5° E	87° W	4-1'
305°	[illegible]	
256°	33° S	~3'
303°	73° NE	2"-1'
320°	10° SW	
345°	81° NE	

Have been mainly in outcrops since [illegible] the beach.

10-60-60
Still in diorite believe its the quartz diorite. Some vegetation [illegible] over talus rubble (?).
Elev. 1761' @ 12^57 @ 62°

Cobbly face of outcrop
Joint:
295° 85° E
Gorge ~ 30' wide what caused this [illegible] jointing, a dike, ??

The diorite varies [illegible] from more [illegible] rich [illegible] at the dam axis to more calcic plagioclase near "The Fins" and the "Fingerbutter".

10-80-81
Still in the calcic rich diorite.
Elev. 1952' @ 1^25 @ 62°

303° 72° SW 2"-?
5[illegible]° 73° NW ~1'-3'

Co

[illegible]

[illegible]

[illegible]

7-29-80

Flew to the camp. Worked on data and wrote memo's.

7-30-80

Today, the plan is to look at the core from BH-6 and then stop at the new drill site BH-8.

This afternoon, I plan on traversing from the knob opposite the "Fins" to the drill platform at the centerline all on the left abutement.

Cont. Timer

BH-6 core

DH-2 2429 @ 11 48 951 311 2262

2740

W-80-84 just downslope of BH-8

Porphyritic andesite basalt

very small outcrop along the small gorge ("V") which traces down to the Susitna

1875' @ 2 32 @ 66°

DH-23 230° ~ 50° SW

Set altimeter

2262' @ 12 55 @ 62°

W-80-8 [illegible] of [illegible]

Grey green porphoritic andesite outcrop 50' high

Joint

348°	86° SW	3'-6'
334°	86° NE	
265°	86° N	3'-5'
260°	vert	
248°	vert	

1929' @ 3.07 @ 62°

W 80-86

Grey/green porphoritic andesite w/ plagioclase phenocrysts, large outcrop

Joint

352°	76° E	1'-4'
338°	74° E	
72°	84° N	1.5'-4'
310'	24° E	3'-5'

335°	58° W	
42°	87° NW	
345°	88° W	

W-80-87

Med to coarse grained crystalline rock chloritic material - probably quartz diorite - slight rexstallization

Joint 355° vert - face of chute

hornblende altered to biotite

Elev 1752' @ 4.15 @ 60°

Watana

2257' @ 6.27 @ 62°

12 hrs.

7-31-50
[#2, 1]

It is currently partly sunny. Will get dropped at BH-8 to look at the contact between the diorite and andesite in the core. Then Dan & I will proceed upstream along the west to just opposite the "Fins". We will then hike upslope towards Quarry site "A".

Witness 2262' @ 7.15 @ 56°

BH-8 CORE

Andesite just above the contact has small inclusions of argillite. Then near the contact diorite breccia is found in the andesite, sharp contact. Then there is a small few inch zone of breccia material mixture of diorite, ~~and~~ andesite, and possibly argillite. Appears that diorite fills the interstices. Hornfelsite is found as xenoliths.

Contact is in the zone of 117.0' to 119.5-120.0'. Just below the contact the diorite is altered somewhat. Good hornblende diorite below with pyrite as an accessory mineral. The diorite is coarsegrained. Diorite inclusions are unaltered, but are finer grained (med gr.)

It appears that the andesite was here first and the diorite was intruded. Some magmatic stoping occurred. There are still other possibilities though.

60 - 66

Questionable outcrop, partially rexstallized biotite diorite, med. grained, gray, green, white.

This outcrop is just below DH-1[illegible], 23 which was done by the cov. Outcrop is ~ 15' across and 5' high.

Joint	325°	75° SW ~1' to
	55°	vert
	44°	70° SE
	350°	55° E

to small an outcrop to get spacing

W-80-87

Outcrop just below crest in the alders. Still the the slightly rexstallized diorite. Some biotite, mostly plagioclase. C.I. ~ 25%

Joints	297°	85° N
	64°	9° NW
	75°	84° N
	48°	vert.

Difficult to locate ourselves. Problems identifying mineral grains. Location looks pretty good

W-80-90

Diorite predominantly plagioclase w/ hornblende & biotite. C.I. ≈ 20% med gr., olive-gray or green/gray.

Joints

317°	87° NE	
15°	28° W	~2½'
300°	72° SW	

12° 85° W

Elev. 1815' @ 10.02 @ 30°
Outcrop is ~ 75' across ~ 15' high
[illegible] covering it.

W-80-91
At edge of seismic line on bt(4")
before the ~ 10' down top of crest.
Diorite; predominantly plagioclase w/
some biotite and hornblende. CI ~ 30%
Medium grained no quartz.

Elev 1870' @ 10.20 @ 60°
Joints:

32°	81° W	8"–2'
41°	85° SE	
307°	76° NE	

W-80-92
Mud slump exposure w/
fresh vegetation at toe. This is
an exposure of till. Clasts are
sub rounded & pomo are polished
and striated. Not a recent slump
Gravel and cobbles in a silty
sand or sandy silt matrix, Semi
compact. Good lodgement till
exposure at least 4' thick
Good spot to get a shovel and dig
in to latter * slight plasticity
Dan has clay.
Slump is wet on NE facing
slope, ~~[illegible]~~ probable pf
W-80-93
Large outcrop of diorite just
downslope of the slump. Lots of
plagioclase, some hornblende and
biotite. CI ≈ 25-30%
Some differential weathering
can be seen on outcrop face.

Joints:

45°	85° SE	
317°	77° NE	
330°	16° NE	
330°	vert.	2'-3'
303°	83° SW	
12°	25° E	1'-2'

Elev 1865' @ 11^{52} @ 63°

Had lunch here

W-80-94

Large outcrop of the diorite. Lots of plagioclase with some biotite and hornblende, C.I. ≈ 25-30%. Difficult to make out the minerals. Med. to co-grained

Joints:

2°	85° W
302°	55° NE
32°	79° NW

- uncertain on spacing see Dans. book

1912' @ 1^{20} @ 62°

W-80-95

Large outcrop of diorite on both sides of a chute ~ 30' wide. Diorite with lots of plagioclase, and some biotite, hornblende (?), and quartz. CI = 25% - 30%. Diorite is medium grained

Joint:

315°	vert.	- major joint for chute alignment
285°	19° NE	

Elev 2002' @ 66° @ 1^{54}

W-80-96

Diorite - the same that we have seen all day. A fairly large outcrop

Elev. 2001' @ 2^12 @ 66°

Joints:

328°	vert.	1'-3'
325°	85° NE	
287°	89° NE	~3'

Flagged

W-80-97

Fairly good size outcrop of diorite. Medium grained w/ lots of plagioclase with some biotite and lesser amounts of quartz and hornblende. CI ≈ 35%. In a little "Y" opposite the "Fins" and it is hidden by alders. More white than green plagioclase here, more sodic?

Joints:

270°	77° S
345°	18° NE

Elev. 1975' @ 62° @ 2^40

Flagged

W-80-98

Slump, fairly fresh, no new vegetation on its surface. Pebbles to cobbles in a fine to med. gr. sand. Pebbles and cobbles are angular w/ no visible signs of glacial transport. Overburden is at least 2' thick here.

Slump faces 340° on a 35° slope. Slump is still wet at its head.

W-80-99

Gray-green porphyritic andesite. Hi degree of chemical and especially physical weathering, shattered. Small exposure. Difficult to determine rock type

Elev 2435' @ 3.57 @ 63°

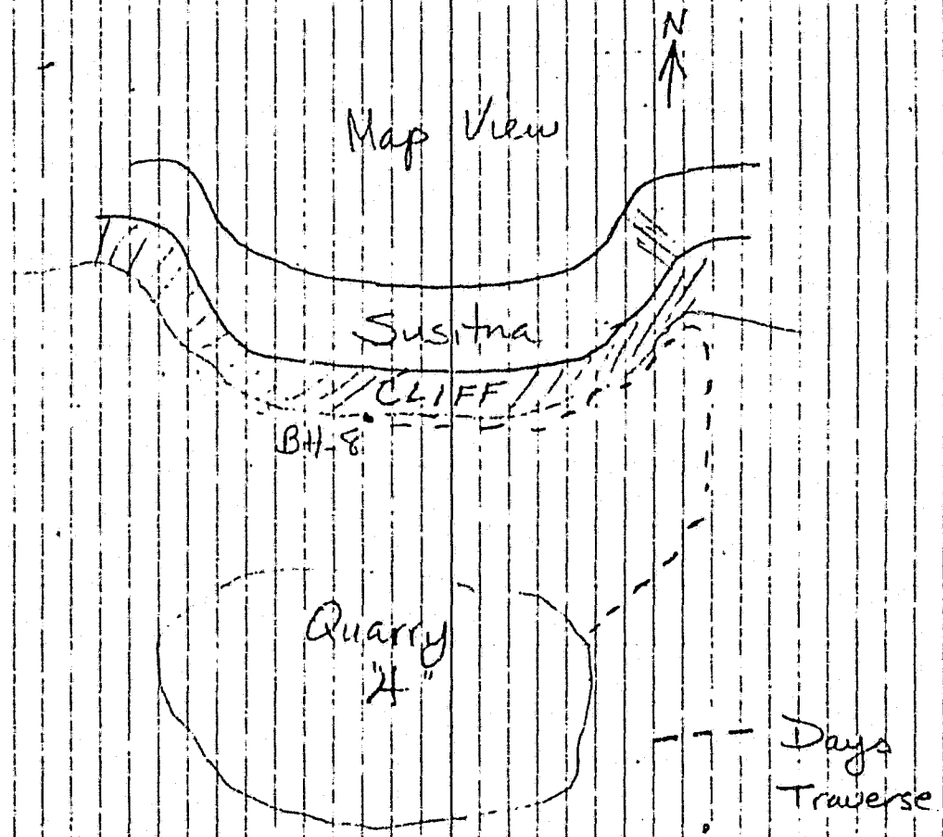
Outcrop is on the last mound going upstream, this high on the abutment

Plagioclase phenocrysts are altered to a pink/flesh color; clay product. Flagged. No obvious outcrops east of here at this elevation

W-80-100

Gray-green porphyritic andesite Outcrop has a rounded surface which is pitted. It is approximately on the east end of the ridge that makes up Quarry site "A". Not sure if this is located correctly. Right behind 80-99 and a little above

Watana Elev.
2277' @ 62° @ 4.55



12 hrs

8-1-80

[#2; 8]

It's a beautiful sunny day. Will fly over the left abutement to circle the outcrops that we saw yesterday and to plan the day for walking around Quarry site "A", starting from the east and working towards the west.

Wutana

2262' @ 6^{45} @ 57°

Flew over left abutement from east of upper edge to top of Quarry "A". Some outcrops behind Quarry "A" on fairly flat terrain

W-80-100

Elev: 2457' @ 7^{56} @ 59°

W-80-101

Green-gray porphoritic andesite w/ plagioclase phenocrysts aver. 1mm and up to 2mm. Small amphibole (?) phenocrysts which seem to be altered, thus it is difficult to see ~~on~~ any

cleavage. Rounded outcrop knob. Outcrop is approx. 20' high w/ some exposures. Knob is covered by a thin veneer of vegetation mat.

Elev. 2462' @ 62° @ 8^{34}

Joints:

306°	80° NE	~4'
292°	81° NE	
295°	74° SW	

Sampled

W-80-102

Green-gray porphoritic andesite plagioclase phenocrysts ~~fr~~ aver. 1-2mm. Phenocrysts have rextallized but they still display some twinning. Fine grained green-gray ground mass

Elev. 2490' @ 9^{03} @ 62°

Joints

26°	86° NW
259°	87° N

W-80-103

Porphoritic andesite ~~base~~, green gray, plagioclase phenocrysts are 1-2 mm. Small outcrop 2' high and approx 20' long.

Joint 58° vert general

Elev. 2520' @ 9[27] @ 62°

check location of

W-80-104

Gray porphoritic andesite; fairly large exposure on the streamlined knob. No cliff face to the outcrop just around surface exposed on top of knob where there are open areas in the vegetation mat.

2504' @ 9[52] @ 62°

Small erratic on top of outcrop qtz. diorite or granodiorite

W-80-105

Gray porphoritic andesite outcrop At base of slope facing N-NE (small cliff 15' high - Phenocrysts over 1mm.

Joints

90°	87° N	1'-3'
352°	62° E	1'-3'

W-80-106

Appears to be gray, porphoritic andesite (color). Heavily weathered outcrop, couldn't see any fresh surfaces. Heavy iron stain

Joints:

45°	80° SW	1'-2'
330°	vert.	1'-2'
86°	41° N	

Elev.

2343' @ 10[41] @ 61°

W-80-101

Gray-green porphoritic andesite with (unbound) a small pod of gray fine grained mass w/ small rod shape phenocrysts of hornblende. Flow structure observed in outcrop, alignment of thin argillite ~~crys~~ inclusions

Joints

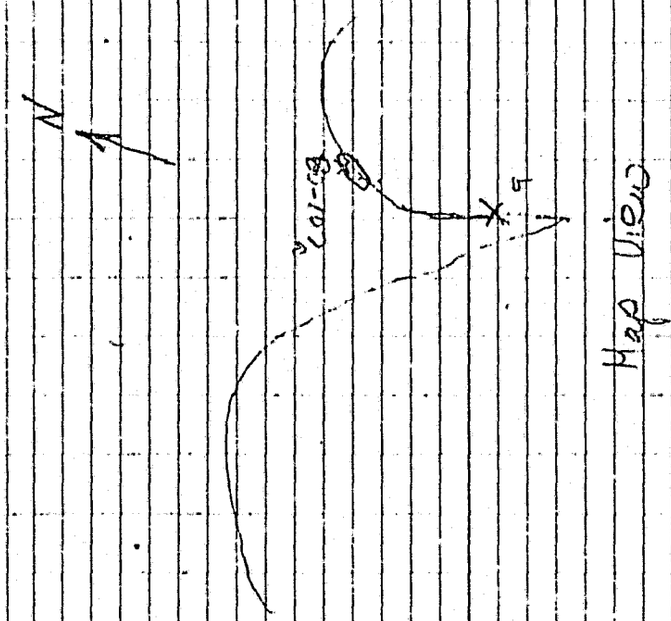
343° 89° SW
85° 86° N

Hand specimen, rate flow structure
Took pictures of, #28 & 29

287° 83° N 6"-1'
287° 87° N
15° 85° E 6"-2'
307° 87° SW

325° 45° SW

Elev.
2344' @ 12[21] @ 66°



Pitted surface of this face. Could be due to differential weathering of the argillite. This probably unlikely as the % of argillite would be very high and this is doubtful. Could also be due to differential weathering of the andesite.

W-80-108

Green-gray porphyritic andesite w/ aver. phenocrysts ~1mm. Also has small inclusions of argillite.

Elev. 2301' @ 1248 @ 66°

Joints:

315°	78° NE	2'-3'
315°	85° NE	
282°	23° S	
290°	27° N	
85°	88° S	

A fairly large outcrop cliff 10'-12' high

W-80-109

Dark gray slightly porphyritic andesite. Fewer phenocrysts and they are small. Outcrop is ~20' across and ~10' high. A small spec of quartz was seen, insignificant

Elev. 2312' @ 1223 @ 66°

Joints:

355°	45° W	
40°	vert	6"-1'
355°	84° E	

W-80-110

Gray Green porphyritic andesite w/ phenocrysts ~1mm. It is a large outcrop ~50 feet high and at least 100' long, a cliff face. As usual, it has white plagioclase phenocrysts.

Joints

287°	79° NE
40°	85° NW

Also contains argillite phenocrysts

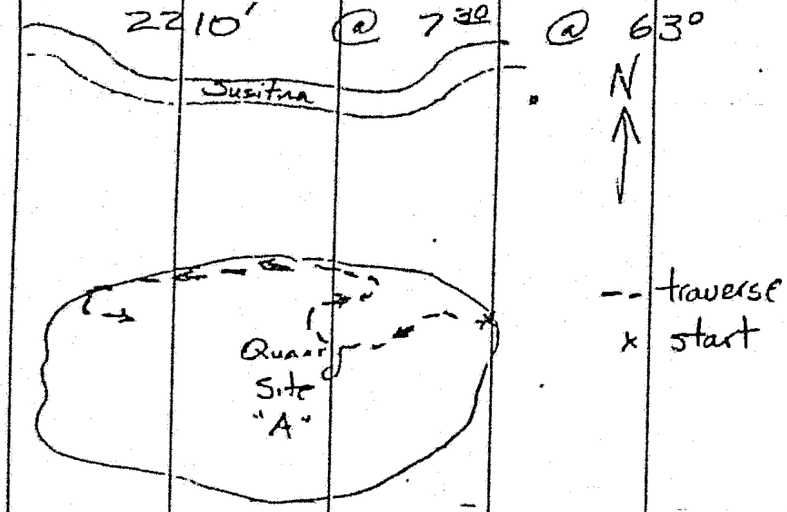
Elev. of base of cliff

2371' @ 1243 @ 66°

All work today was done on the left abutement in Quarry site "A"

Watana

2210' @ 7[30] @ 63°



12 hours

8-2-80

[#2, 15]

It's a partly sunny morning. Will get dropped at Quarry site "A" and finish up mapping there, right above the centerline area.

Watana 2262' @ 7[20] @ 53°

W-80-121

A porphoritic rock with a dark gray groundmass. White phenocrysts are predominantly plagioclase. Seems to have some very small quartz phenocrysts. Thin sections will be needed to determine this. Resembles the andesite, except for the groundmass color, but if quartz is present, might be called a dacite. Some phenocrysts of argillite.

Elev. 2542' @ 8[5] @ 57°

W-80-111

Green - dark gray porphoritic andesite phenocrysts are generally ~1mm or less. Some argillite inclusions. Large outcrop, 30' high .. 40' across

Joints:

355°	85° E
257°	81° N
311°	20° N-NE

Elev. 2360' @ 66° @ 2°'

W-80-112

Green - dark gray porphoritic andesite. Plagioclase phenocryst ~1mm in diam. Some quartz was found in one specimen but not enough was seen to warrant calling it a dacite. Sampled fairly weathered, no clean surfaces

Elev. 2358' @ 2[27] @ 63°

Joints

75°	88° N-NW	
328°	62° NE	
335°	70° NE	6"-2'
80°	74° N	
~ 350°	15° E	1'-4'

(b) 2nd outcrop

312°	86° S-SW
358°	65° E
12°	86° W
5°	25° E

Two large outcrops [illegible] to each other

W-80-113

Green light gray porphoritic andesite with inclusions of argillite. Can get some good fresh surfaces here. Outcrop is ~25' high, ~100' long

Elev. 2291' @ 2[54] @ 63°

Joints

68°	88°	SE	6"-1'
77°	83°	N	
320°	80°	E	6"-1"

Could parallel near vertical jointing here

(L) 47° vert.

J-80-114

Dark gray porphyritic andesite. White plagioclase phenocrysts are a pink/flesh color when weathered. Small outcrop on top of ridge rather than at base of ridge where the last several stations have been. This will be our furthest point west along this ridge

Elev. 2369' @ 3^{28} @ 67°

W-80-115

Coarse grained, white-green-gray diorite. It appears to have quartz in it, thus its probably a quartz diorite. Some biotite and hornblende. C.I. = 25% - 30%

Elev. 2395' @ 3^{47} @ 68°

Joints:

267°	78°	N
322°	83°	NE
2°	70°	E
274°	78°	S

W-80-116

Medium grained diorite or quartz diorite. C.I. ~ 25%. The outcrop has sub-rounded diorite cobbles (up to 6") which are included in the diorite outcrop. See photo

Elev 2449' @ 4^{40} @ 65°

Rich Harkness picked us up early, 4:30. So we went back to camp and picked up photos and flagging tape. We flew around the south and south east end of Quarrywile "A" looking for outcrops in the fluted surface north of the Fog Lakes where exposures are almost non-existant.

W-80-117

Gray-Green porphoritic andesite. Outcrop faces north on edge of streamlined form. It's a couple of [illegible] 15'-20' high

W-80-118

Small rock exposure of Gray-green porphoritic andesite. Exposure is on a gently domed streamlined form. It was approx. 20'-30' in diameter.

W-80-119

White-green-gray medium to coarse grained diorite. Outcrop is aprox 50' long and 10' high. Elev. ~2152' @ 5:55 @ 62°

It is in the area of the traverse that we did yesterday.

W-80-120

South of Deadman Creek on the south abutment. Exposure of argillite at the top of the cliff. Good area to check the overburden. See Dan's book

Joints:

334°	80° NE	3'-4'
83°	83° N	~3'
67°	82° SE	1'-3'
75°	86° NW	
312°	88° NE	
325°	40° SW	~2'

Outcrop is ~45' long and 10' high

323°	37° SW

W-80-122

A porphoritic outcrop with a dark gray groundmass. Appears that all the phenocrysts are plagioclase and there doesn't appear to be any quartz. If this is true then this is an andesite. Outcrop is ~30' long and 6' high. Outcrop is just south of 80-121 and same elevation. Surface that [illegible] separates the two outcrops

W-80-123

A porphoritic rock with a light gray groundmass. Has a rhyolitic texture. It has phenocrysts of white plagioclase, hornblende rods, some quartz and large inclusions of argillite. Phenocrysts are generally ~1mm except for the argillite, phenocrysts up to 12 mm long.

Elev. 2575' @ 10^06 @ 58°

This whole knob is a rhyodacite. Have to define its border. It's possible that w/ the andesite flow, there is an area of rhyodacite with a transition zone of dacite. Specimens have good hornblend xtals.

Stopped here at W-80-104

W- 80-124

Green white co. grained diorite rock. It's either quartz diorite or granodiorite. Large flat outcrop 20' in diameter. Flagged this outcrop.

Elev. 2620' 10^{50} @ 61°

Quartz can be seen in this rock. This outcrop has tall clouts on top of it. Outcrop 110' west of it. Two structures on them @ 267° and 255°

* This appears to be andesite with diorite w/in, a mixture

W- 80-125

Green andesite groundmass w/ some evidence of diorite. Rounded outcrop has tall clouts on top of it. It has diorite xenoliths

Joints:

290° 70°N

327° vert.

W- 80-126

Green andesite groundmass with inclusions of diorite

Elev. 2587' @ 11^{22} @ 58°

Joints: 31

317°-328° 87° NE

331° 81° SW

313° 62° NE

Approx 125' downslope w/ have all porphyritic andesite

W- 80-127

A porphyritic rock with a dark gray groundmass. Dan thought that he saw some quartz. It's either a dacite or andesite

Joints

280° vert

330° 73° NE

W-80-128

A porphoritic rock with a dark gray groundmass. Can't see any quartz phenocrysts in this outcrop. Phenocrysts are weathered to a pink/flesh color. Outcrop is pretty rotten on this knob. Sampled

Elev.
2535' @ 11^{5x} @ 57°

Joints:
345° 27° E
5° 48° E 6"-1'

W-80-129

Green porphoritic [illegible] with white plagioclase phenocrysts. [illegible] quartz phenocrysts were found.

Joints:
77° 80° SE
12° 29° E

W-80-130

Green porphoritic andesite w/ some inclusion of diorite.

Elev. 2564' @ 1^{10} @ 59°

Joints:
43° 81° NW 18" [illegible]
312° 84° NE
[illegible] 22° NE

W-80-131

A gray porphoritic rhyodacite. A gray groundmass w/ hornblende (rod-shaped) [illegible], quartz, and plagioclase. Small outcrop. Flagged

Elev. 2592 @ 1^{25} @ 5[illegible]

W-80-132

A porphoritic rock with a dark gray groundmass. The plagioclase phenocrysts are 1-2mm in size. Can see a couple of quartz grains here. It's probably an andesite rather than a dacite. Locate this spot from the air

Elev. 2569' @ 3⁰⁰ @ 57°

Joints:

298° vert. ~ 2'

50° vert.

W-80-133

A green porphoritic rock. Few phenocrysts and those that can be seen are small. There is an [illegible] that quartz may be in this outcrop, thus it may be a dacite rather than an

andesite.

Elev. 2535' @ 3¹⁵ @ 57°

W-80-134

Diorite [illegible] just above DH-14. Small outcrop ~ 30' long & 5' high

Elev 2194' @ 4³⁵ @ 56°

At DH-[illegible], they are [illegible]

230'

[illegible] 135 also W-80-117

[illegible] porphyritic rock with a gray-green groundmass. It has phenocrysts of [illegible] and [illegible]. Outcrop [illegible] appear [illegible] high and off and on [illegible] long. Didn't seen any quartz, thus andesite, sampled

Elev. [illegible] @ 5^{30} @ 56°

Joints:

10°	67° N	
270°	9° N	18"-2'
349°	vert.	

Streamlined form has a thin fireneer of till on its N edge. Clasts are rounded, some are polished and striated.

W-80-136

Dark green-gray porphyritic rock. Plagioclase phenocrysts are altered to clay, pink-flesh in color. No quartz seen. sampled

Joints:

104°	76° N
20°	65° E
75°	75° N-NW
350°	76° W
2[illegible]°	85° S
100°	[illegible]° S

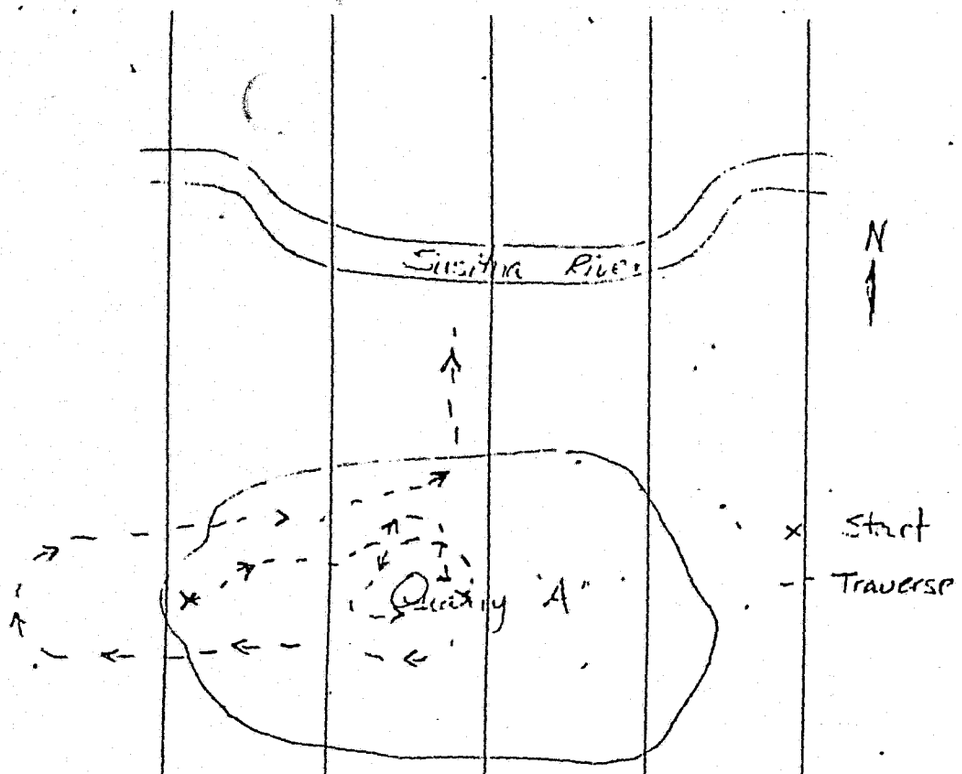
Outcrop is a 20' high and off and on several hundred feet long. Outcrop near this one had no phenocrysts, very fine-gr. groundmass. Sampled

Helo elev. 2500'-150
2350'

Watana

2368' @ 7^{52} @ 54°

Finished up Quarry site "A" today. After finishing up, we [illegible] south and east of the site. There are alot of outcrops to the southwest of Quarry site "A". For the most



Part Quarry "A" appears to be composed of andesite with some rhyodacite, possibly dacite and andesite with diorite phenocrysts. Only thin sections could determine if there is any significant dacite or rhyodacite.

13 hours

8-6-80

Dan and Larry are doing a traverse on the left abutment downstream of the Watana dam site. Willi and I are flying along the Susitna near and downstream of Borrow site "E" on the left abutment. Talked with J. Gill and J. Lawrence.

W-80-105

Green slightly porphyritic andesite. Has some small white plagioclase phenocrysts and some hornblende (?), all less than 1mm.

Joint

15°	82° E	1'-4'
102°	82° S	1'-3'
330°	vert	
42°	13° SE	
68°	88° S-SE	

Outcrop is approx ≈60' and 100' across. Elev ~1480' on the small side channel.

Joints
343° 13° E-NE ~3'-4'
350° 75° E

W-80-186

Green andesite, fine grained, aphanitic rock, No phenocrysts seen in this outcrop. Surface of outcrop is mainly oxidized. Outcrop is a small cliff on the Susitna

Joints * 292° 77° N
27° 67° W
* 6° vert 3"-2'

W-80-187

Same as [illegible] but slightly porphyritic

Joints
302° 76° S } 4"-2.5'
297° 78° S

W-80-188

Green to mostly green-gray fine grained andesite. No significant amt of phenocrysts observed. Seems to have a few argillite inclusions but I'm uncertain (maybe in the previous sites?) Small outcrop 2'-3' above river level and sticks out 35'-40' from shore

Joints
282' 85° N-NE } 1'-4'
275' 76° N-NE }
343° 73° S ~5'

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D. PEDERSEN

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[#1, 106]

* 470-500 - transition from andesite to diorite - noted brecciated andesite w/ diorite filling interstices between and. fragments - noted partial assimilation of and. & subsequent [illegible] in diorite in areas of assim. at 47' - definite flow structure is [illegible] andesite indicating re-[illegible] of and. along Diorite [illegible] & of Diorite [illegible] - diorite is finer grained at [illegible] & (chill zone) between and. fragments.

Diorite at 57' is med. gr. C.I. = 30% hornblend alt. to epidote, ≈ 70% plagioclase prob albite - Minor secondary pyrite. (Hornblende Diorite) - This designation of hornblende comes from association more than actual vis. recognition of hornblend cleavage. The grains in this diorite are recrystalized and not always recognizable.

2

80-88

Partially Recrystalized - Biotite - Diorite C.I. ≈ 3% biotite, & rexalized Hornblende, plagioclase ≈ 70% - minor secondary pyrite grey w/ slight pinkish yellow cast on weathered surfaces. Possibly small amt. of qtz.

1. N 55° E, 68° SW

2. N 38 W, 78° SE

Elevation 1,898', 57°. 8:40 AM

Downslope is blocky talus

3. 275° - 85° N

80-89

Partially Recrystalized Biotite Hornblende Diorite C.I. ≈ 30% - Plagioclase ≈ 70%, grey - possible qtz grains but not possible to determine in field.

1. N 42° W, 86° SW

2. N 38 E, 82° N

Elevation 1,856' 57° - 9:27 AM

Difficult to locate our position exactly on air photo

80-90

Grey partially recrystalized Biotite Hornblende Diorite, C.I. ≈ 35%, 65% Plagio-clase & minor Alk. fed. med. gr.

(Joint Spacing)

1. N47°W, 89°NE (8" to 2')
2. N33°E, 88°NW (4" to 3')
3. N70°E, 4°W (8" to 2')

80-91

Grey partially recrystalized Hornblende, Biotite Diorite - C.I. - 35%, 65% Plag-ioclase & minor alk feldspar. Possibly small qtz.

Joint Spacing

1. N47°W, 90° (8" to 2')
2. N10°E, 75°E (4" to 2')
3. N90°E, 37°N (1 to 3')
4. N20°E, 65°W (8" to 2')

80-92 -

Stump in glacial till - Scar approx 70' x 20' - soil is sandy, silty gravel w/tr to some clay, cobbles ≈ 10%. Probably lodgement till, relatively compact and well graded.

Elevation - 1,995' at 11:15 AM, 62°

80-93 -

Grey med. grained Hornblende, Biotite Diorite, partially recrystalized, CI ≈ 35% ≈ 65% Plagioclase & minor alk. feldspar

Joint spacing

1. N60°W, 80 SW (1' to 3')
2. N35°E, 90° (1' - 3')
3. N40°E, 42°W (.75' - 2.0')
4. N45°E, 36°SE (.75' - 2.0')

Elevation 1,865', 63°, 11:52 AM

80-94

Grey - partially rexalized, Hornblende, Biotite - Diorite, med. grained - twinning striations [illegible] on 10% of Plag. feldspar cleavage surfaces.

Joint Spacing

1. [illegible]5°W, 68° SW (.5'-1.5')
2. N90°E, 35° N (1'-3')
3. N23°E, 90° (.5'-1.5')

Elevation 1,912'

This diorite has an irregular weathered surface with depressions where some of the feldspar has weathered out. Possibly [illegible]

80-95 Grey partially rexalized, Hornblende Biotite - Qtz. Diorite - % qtz in excess of 10% plainly visible as isolated grains in Diorite. CI ≈ 30%, ≈ 58% Plagioclase, w minor Alk. feldspar, qtz ≈ 12% grey, smoky color.

Joint Spacing

1. N65°E, 82° S
2. N55°W, 85° S
3. N15°E, 54° SE
4. N12°W, 32° SW

Very closely Jointed for all surfaces

Elevation - 2002'

80-96

Grey hornblende, biotite, diorite CI. ≈ 30%, 70% Plagioclase w/ minor Alk. feldspar. Possibly small amt. of quartz. Noted good clear twinning striations on some feldspar cleavage surfaces. Partially recrystalized,

80-97

Grey partially recrystalized hornblende, biotite qtz. diorite. C.I. ≈ 30%, 55% plagioclase feldspar w/ minor alkalic feldspar, qtz ≈ 15%.

1. N45°W, 77° SW
2. N70°E, 90°
3. N27°W 89° NE

Very difficult to ascertain joint spacing at this location

Elevation 1,975'

80-98

Bn Sandy gravel w/some silt - angular cobbles ≈ 15% - Small Slump 25' x 10'
Soil is non glacial.
Elevation 1,941' 3:00 PM 64°

80-99

Grey-Green Porphyritic Andesite very decomposed - all phenocrysts of plagioclase have altered to clay minerals. This outcrop is too badly weathered to obtain joint spacing, And. also contains clasts of argillite.
Elevation 2,435'

80-100

Gy-Green Porphyritic Andesite, partially recrystalized. Phenocrysts of plagioclase, moderately weathered. Outcrop was rounded off by glacial action and it was no possible to obtain joint spacing.

(8/1, [illegible])

[#1, 118]

80-101

Grey Green porphyritic Andesite, phenocrysts of plagioclase and possibly hornblende & biotite, approx size of phenocrysts is 1 mm to 2 mm. Phenocrysts are recrystalized and it is not possible to see twinning striations in the plagioclase, also present in fine gr. And. matrix are clasts of argillite some clasts are baked and bleached to a light green color.

1. N60°E, 77° NW
2. N60°W, 20° SW

80-102

Grey Green Andesite w/ phenocrysts of plagioclase and hornblende, more grey than at Station #101 and a greater % of hornblende is present.
1. N65°E, 76° NW
2. N4°W, 72° E

80-103

Gy Andesite w/ phenocrysts of plagioclase

Elevation - 2,520

80-104

light Grey - porphyritic andesite to dacite w/ phenocrysts of Plagioclase, biotite, & hornblende. It was not possible to take joint orientations at this outcrop. Possible presence of quartz eyes texture is characteristic of dacite.

80-105

Gy Porphyritic Andesite, w/ phenocrysts (avg size 1mm) of plagioclase and biotite, small clasts of argillite interspersed through Andesite.

Joint Spacing

1. N 62°E, 90° (4" to 1')
N 0°E, 90° (4" to 1')

80-106 Gy porphyritic andesite, badly weathered. Clay present as replacement mineral for plagioclase phenocrysts. FeO_2 Stain on weathered surfaces, possible sulphur stain on one joint face.

80-107

Gy porphyritic Andesite - w/ hornblende, plagioclase and biotite phenocrysts. Noted an inclusion of partially assimilated host rock (probably argillite).

Joint Spacing

1. N 84°E, 88° N (2" to 8")
2. N 26°W, 56° SW
3. N 9°E, 74° NW

On a weathered surface the Andesite is differentially weathered resulting in a series of ridges and grooves running in a parallel direction.

80-108

Grey, green porphyritic andesite w/ phenocrysts of plagioclase and lesser bodies of amphibole. Weathers rough with phenocrysts sticking out from matrix.

		Joint Spacing
1. N 90° E,	79° N	(4" to 2')
2. N 32° E,	75° SE	(4" to 2'

80-109

Dark grey porphyritic andesite w/ phenocrysts of plagioclase. After, breaking numerous rocks off of the outcrop I found a piece of andesite containing a very qtz rich zone on one end. I could find no further examples of this phenomenon at this outcrop.

Elevation 2,318' 1:23 PM

80-110

Gy-green porphyritic andesite w/ plagioclase phenocrysts ≈ 1 to 2mm, and clastic fragments of argillite.

1. N 36° E, 78° NW
2. N 65° E, 78° NW

80-111

Gy green porphyritic andesite w/ plagioclase phenocrysts ≈ 1-2mm, small clastic fragments of argillite, Fe_2O_3 stain on weathered surfaces.

1. N 65° E, 90°
2. N 33° W, 32° NE

80-112

Dark grey porphyritic andesite w/ qtz. Dark grey porph. andesite w/ qtz. phenocrysts of plagioclase in both rock types as well as clasts of argillite.

1. N 65° E, 75° NW
2. N 78° W, 50° NE
3. N 60° W, 85° NE
4. N 70° E, 90°
5. N 28° W, 64° NE

80-113

Grey porphyritic andesite w/ phenocrysts of plagioclase, and clasts of argillite.

1. N 77° W, 90°
N 74° E, 90°
N 32° W, 41° NE

80-114

Gy porphyritic andesite w/ plagioclase phenocrysts badly weathered.

1 N 78° W - 90°
Elevation - 2,369

80-115

Grey
Medium gr. hornblende quartz diorite w/ secondary biotite.

1. N, 77° E
N 90° E, 90°
N 63° E, 27° NW

80-116

Grey med. gr. hornblende qtz diorite w/ cobble size xenoliths of diorite included throughout. Xenoliths range in size from a few inches to 15'.
Mike had measurements
Elev. 2,449

80-117

Grey porph. andesite w/ phenocrysts of hornblende & plagioclase
Measurements in Mike's notes

80-118

Grey green porphyritic andesite
Measurements in Mike's notes

W 80-119

East of Quarry "A". Diorite outcrop, rounded outcrop surrounded by wet tussuck tundra w/ spruces. Outcrop ≈ 30' long and 2' high

80-120

68° - 75° NW

Aq. ... - dark grey - overturned i.e. mudcracks.

2p60' - at 6:12 PM

(8-2-80) Quarry site "A"

80-121. [#1, 133]

Dark grey porphyritic andesitic to dacitic rock, phenocrysts of plagioclase, and a few small qtz phenocrysts. Clasts of diorite and argillite. This rock appears chemically transitional from andesite to dacite as evidenced by the presence of a few small qtz phenocrysts. Thin sections should be made to verify classification

+1)

1. 114°, 84° N
2. 50°, 80° E
3. 30°, 35 NW

Elevation - 2,542

80-122

Grey Green porphyritic andesite, phenocrysts of plagioclase, clastic fragment of argillite. No vis qtz.

80-123

Light grey porphyritic rhyodacite w/ phenocrysts of hornblende, qtz & plagioclase, clastic fragments of argillite are also present.

It was not possible to obtain joint orientations & the location due to the badly weathered nature of the rock.

Elevation - 2,575'

80-124

Green Grey andesite w masses of partially assimilated quartz, weak diorite.

80-125 - Green grey andesite w/ phenocrysts of plagioclase and rounded clasts of diorite.

1. 280°, 90°
2. 10°, 64° W

80-126

andesite as at station #125

1. 25°, 76° E
2. 124°, 90°

80-127

Grey porphyritic dacite w/ phenocrysts of plagioclase and quartz.

Measurements in Mike's Notes

80-128

Measurements in Mike's Notes

80-129 Gy green porphyritic andesite w/ phenocrysts of plagioclase and clasts of argillite. Observed 1 qtz pheno.

1. 84°, NW
2. 11°, 90°

80-130 -

Gy green andesite w/ plag. pheno.

1. 32°, 78° W
2. 290°, [illegible] NW

80-131
In Mikes Notes

80-132
Gray green porphyritic andesite dacite
there is ≈40% qtz vis in this rock
indicating that it is transitional
[illegible] from andesite to dacite.
Plagioclase altering to clay minerals
is the major phenomenon in this rock.

Elevation - 2,569' 3:00 PM

80-133
andesite-dacite as at station #
132.
Measurements in Mikes Notes

134 In Mikes notes

135 In Mikes Notes

8-3/80 [#3,1]

Begin traverse at the kerb opposite the fence, and work downstream as far as we can along the left abutment Watana.

80-137

amber grey med to crse gr. mesocrystalline hornblende qtz diorite partially recrystallized. Qtz form largest grains in sample. It was not possible to obtain joint orientations at this site.

Elevation 1,556

138 Grey med to crse. gr. mesocrystalline, hornblende qtz diorite w/numerous recrystallized areas, and partially recrystallized.

Elevation 1,644'

		Joint spacing
1. 122°,	44° N	1' to 5'
2. 138°,	86° N	6" to 2'
3. N,	24° W	1' to 3'
4 245°,	82° E	6" to 1'

80-139

Grey biotite hornblende diorite partly recrystallized + mesocrystalline

Elevation 1,455

80-140

Grey biotite hornblende diorite, partly recrystallized mesocrystalline. CI = 30

Measurements in Mike's Notes

80-141

In Mike's Notes

80-142

Grey hornblende, biotite diorite, partly recrystallized.
Elevation 1544

80-143

(8-4-80) Right abutment from fine to Deadman (Page 8 in Book #3)

80-144

amber, Grey, green fine to med gr. hornblende diorite

1. 316°, 78° NE
2. 64°, 52° SW
3. 50°, 38° NW
4. 334°, 78° NE

80-145

Grey biotite — qtz diorite partially recrystallized. Weathers rough with biotite and more resistant feldspar forming little rises and less resistant types forming depressions

80-146 - Grey biotite qtz. diorite - weathers as above.

1. 64°, 85° SE
2. 333°, 67° NE
3. 318°, 89° S

80-146

Grey medium grained biotite diorite granular, rough on weathered surface. possibly some vis. quartz? CI = 25%

80-147

Grey medium grained biotite diorite partially recrystallized. Very coarse & granular on weathered surface

1. 94°, 24° NW
2. 308°, 68° N
3. 330°, 90°
4. 92°, 90°
5. 318°, 27° SW
6. 350°, 90°

80-149

Gy. fine to med. grained biotite diorite, w/ possibly some qtz grains. weathers rough & granular, CI = 18.

1. 10°, 47° W
2. 90°, 65° S
3. 345°, 78° NE
4. 263°, 15° N (2" to 1')
5. 33°, 43° SE (

80-150

Gy-medium gr. biotite diorite - partially recrystalized.

80-151

Grey med. gr biotite diorite cross cut by 1.5' thick felsic dike. Possibly residual siliceous liquors which filled fissures beginning to open in the cooling diorite. Or the product of a later stage of magmatic activity

1. 285°, 68° SE
2. 35°, 62° W.

80-153

Ambergrey hornblende quartz diorite with felsic dikes of fracture fillings from 2" wide to 4" wide.

1. 347°, 84° NE
2. 328, 40° NE
3. 94°, 76° SE
4. 335°, 74° SW

80-154

Grey med gr. hornblende qtz diorite partially recrystalized

1. 297°, 50° S
2. 75°, 25° NW
3. 25°, 75° E

80-155

Grey biotite qtz diorite, med. gr., partially recrystalized

1. 300°, 90°
2. 230°, 30° W
3. 354°, 57° NE

80-156

Grey biotite hornblende qtz diorite, partially recrystalized.

1. 100°, 88° S
2. 310°, 90°
3. 40°, 85° E

80-157

Grey med. gr. hornblende, qtz. diorite partially recrystalized.

Dan Pedersen's work

Dan Pedersens Notes on this traverse [#3, 21] are in Bruens Book #3 8-5-80

Larry will use the book today.

10:00 AM Aug 5 Tues. 1980
Acomb - Bruen - Pat - Will
[illegible] - 64°
fresh breeze - after ≈40 minutes
outcrop getting fly over

W-80-159 first stop of day
at small lake across from
drillers water pumps.
Altitude 2388' 10:19 66°

rock type: fine grained,
porphyritic amphibolite -
light & dark gray weathering to a lighter
more greenish gray
strong red iron stain in some joints
Joints - difficult to measure because of
small - low angle - outcrops
N 70° to 80° W ≈85° N spacing 2'
N 15° E 86° W .5 to 2'
subhorizontal set spacing .5 to 2'
no measurement

W-80-160

Alt[illegible]: [illegible]

[illegible] [illegible] [illegible] [illegible] [illegible] [illegible]
[illegible] sandstone
varies from fine to coarse grained
gray green color

bedding: Wild [illegible]
N50°E 25°S

Joints

to [illegible] - rock has [illegible]
[illegible] less granular texture
more green -

W-80-161 & 162

green gray med grained basaltic andesite
very fresh - hard

			spacing
Js	N 84°E	85°N	
	N 40°E	90°	
	N 76°W	76°N	2'-4'
	N 15°E	85°E	2'-4'
Very strong	N 65°W	25°S	<1"-2"
	N 55°W	80° to 83°N	
	showing	slickensides	

stop 162 is about 500ft
west of stop 161

W-80-163

West end of Lake
near water [illegible]

basaltic andesite
med-grained, [illegible], [illegible]

J's N 80°W 73°N
≈ N° S and vertical
N 40°E 86°W

between 162 and 163
is a finer grained
lighter green more andesitic
phase.

W-80-164

slightly porphyritic andesite

what is extent of the
lithic Sandstone of stop 160 —
maybe it occupies the swale
only and is without exposure
beyond that described at 160.
In any event the volume of
SS compared to the volume
of andesite vastly descreases
its importance.

W-80- 165 -

andesite and porphen
[illegible] - medium gray
green fine grained [illegible]

N 66°E 90°
N 35°E 72°E

[illegible] green more [illegible]
[illegible] at 160 [illegible] SS.
[illegible]
weathering.

W-80-166 - at waterfall

Andesite and porpheritic
andesite

N 83°E 70° S
same [illegible] N 55°E 50° NW
N 45°E 42° NW
N 60°E 35 NW
N 65°E 35 NW
N 30°W 86° NE

1" to 5"

W-80-167

Diorite - fine grained
fairly dark - not much sodic
more calcic plagioclase -
fair well [illegible]

J's N 47° [illegible] 14° N
spacing 1' to 4' → N 11° W 73° W
N 86° E 67° N
N 42° W 87° NE

[#3, 32]

Aug. 6 - 1980

Pederson & Acomb
complete overcast 60°
Pilot Rich
Left abutment opposite fingerbinder
to high water channel at
southward bend - ≈ 2+ miles

W-80-168

very dark Diorite becoming
gabbroic - mostly Calcic plagioclase

N 10° W 74° E 2' to 4'
N 75° E 78° NW 3' to 5'
N 80° W 4° S 6" to 1'

W-80-169

porphyritic basaltic andesite

Js N 55° W 78° S 1" 2"
N 58° E 22° S 1" 2"
N 15° E 85° W 1 to 4'

lt. sodic plag phenocrysts.

W-80-170

porphyritic andesite
more greenish than 169
[illegible] more [illegible]

N 35° E 68° SE 2" to 5"
N 74° W 76° N } 2'
N 70° W 66° N

W-80-171

Diorite - apparently [illegible]
[illegible]

rich in Calcic plagioclase
minor hornblende + biotite
some alteration to lt. green + pinkish
N 28° E 76° SE
N 28° E 33° [illegible]
N 90° E 90°

W. 80 - 172

grading [illegible] to
[illegible] from
[illegible]
inclusions of [illegible]
[illegible] andesite
about golf ball size

N 28°E	71°E
N 20°W	83°NE
N 10°E	69°E
N 60°W	7[illegible]
N 45°W	26°NE

173
Adt -
[illegible] andesite
[illegible]
some pyrite

N 60°W 84°V
N [illegible]

W-80-174

Altered Andesite
maybe from shear
stress interpretation
by Dan - I don't
know what it is maybe
rental, SS
Js - Dan has them

— A new pencil —

upon further studies (chipping)
we feel that the clastic
lithic SS. or an arkose hypo
may be more yield

W-80-175

opposite upstream side of island
lithic sandstone,
excellent for Js

N 58°E 86°NW 5" to 2'
N 44°W 90°
N 81°E 90° 2' ft.
N 46°W 62°NE 2'
N 17°W 65°SE 4'
N 40°W 8°NE 2" to 1'

possible bedding based on
faint grain size changes
staining following this trend
~~[illegible]~~ strong parting along trend

downstream bedding changes
so strike is N or
slightly NE

yellow brown weathered clasts
in gray green rock

W-80-176

lithic sandstone
and silt stone → (quartzose)
both show a low degree of
metamorphism
[illegible] a low amount of matrix material
Js N 50W 90° 4" to 2'
N 75E 85°SE 2'
N 60°E 86°NW 2'
N 8°W 69°N 3'

bedding N 42°E 11°SE

W-80-177

metamorphosed lithic sandstone
with matrix = greywacke
volcanics in matrix -
metamorphosed to chlorite -
& some glass shrouds visible?

N 55°W 83°NE 6" to 2'
N 34°W 12°SW 3'
N 80°W 46°N 2'

Fairly massive - no bedding visible

W-80-178

[illegible] sedimentary complex of silicon siltstone & muddy sandstone. —

texture of both [illegible] [illegible] granular [illegible] siltstone has higher gloss smaller fractures

N34°E 89°NW
N30°E 24°NW

W-80-179

Tuff of Dan

rock is dark, mostly calcic Plag
some "shadows"
possibly some glass shrouds

over lying is a pale green tuffaceous siltstone

100' downstream more tuff [illegible]

Js N15°W 65° NE 6" to 1'
N 90°E 90°
N 10°E 70 SE

W-80-180

outcrop 5' above highwater
pale green tuffaceous
siltstone and fine grained
sandstone

J N 87°W 90°
J N 29°W 70° SW no. spacing
N 5°W 5 W "
bedding — spacing 1"
to 5"

below high water is
gray reddish
siliceous siltstone.

W-80-18

once again → a classic →
clastic metasediment gray green
silt to sand size grains

J's N 28°W 70° SW
N 58°E 50° SE
N 5°W 85° E

W-80-182

(+ water level) metasediment - rock X
[illegible] green - [illegible]

(of above) overlying this is a
pale green tuffaceous siltstone

J's N 67° W 74° S 2'
N 15 E 60° E 4'

W-80-183 -
zippo

W-80-184

"Basaltic - very dark
gray -

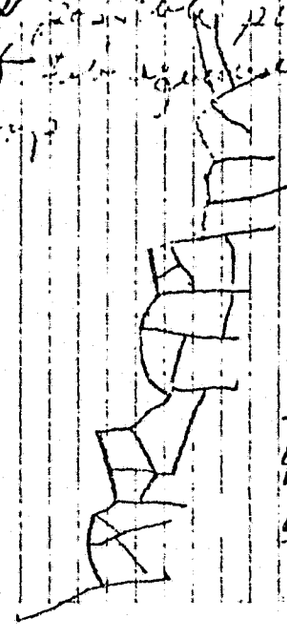
(8-7-80) Left Abutment across from
borrow site "E"

[#3, 42]

80-189

Dark gray andesitic basalt?
w/ [illegible] of questionable genesis
possibly andesite. This rock is also
possibly a water laid tuff [illegible] metased.
Observed possible pillows which would
support [illegible] basalt hypothesis.
outcrop

also observed small vesicle
in [illegible] and xgeins



1. 60°, 65° SE
2. 9°, 12° SW
3. 10°, 82° E
4. 104°, 90°
5. 287°, 80° N

80-190

Dark grey basalt w/ pieces of plagioclase, olivine green waste and chert, fracture fillings, Also noted dark shadowy xzeroliths.

1. 303°, 84° N
2. 412°, 88° NW
3. 20°, 90°

80-191

Grey green tuffaceous greywacke? with fragments of argillite, tuff, andesite basalt, Or possibly perf. recrystallized andesite?

1. 64°, 90°
2. 350°, 60° SE
3. 320°, 5° N

80-192

Dark grey basalt. Mike has orientations.

80-193

I. Mikes notes

80-194

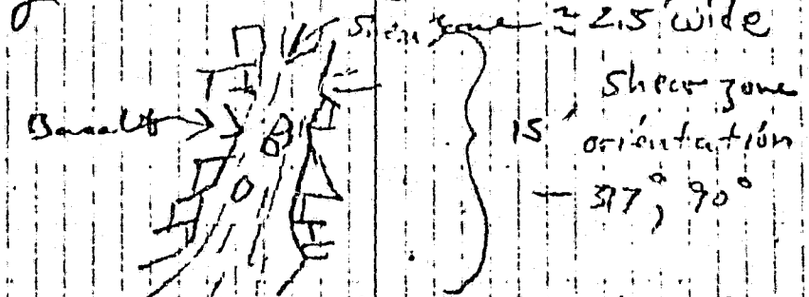
Dark gy, green basalt - weak is blocky. Outcrop is 50' long and 5' wide.

1. 315°, 90°
2. 310°, 90°
3. 275, 62° SE
4. 320°, 33° S

Jointing ranges from 2" to 1'

80-195

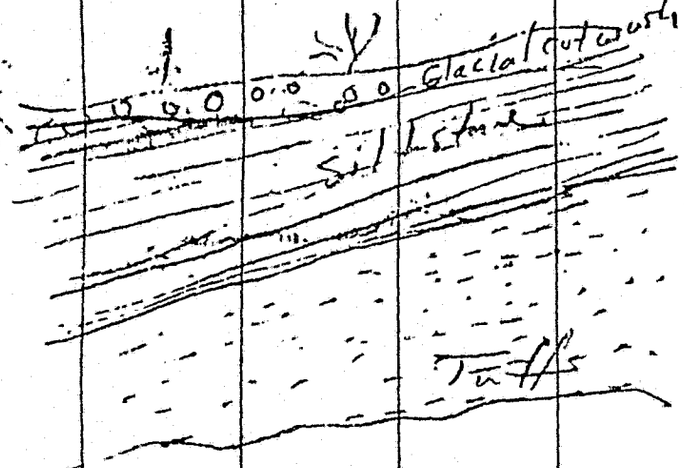
Gy andesitic basalt



Numerous slickensided surfaces at 105°, 90°
gouge zone ≈ 2.5' mostly gouge a few badly decomposed blocks of basalt.
2. 352°, 57° SW 4. Slickensides 297°, 42° SW
3. 26°, 84° SW

80 - 196

Green - grey clastic metavolcanic or tuff overlain by a tuffaceous siltstone. This [illegible] displays a layered effect in the tuffs created by elongate clasts of [illegible] possible devitrified volcanic glass. Large pieces (small lumbs) are replaced by Calcium carbonate or zeolites. Above this tuff is a darkly banded tuffaceous siltstone.



Hand sediment taken

1. 9°, 82° NE
2. 272°, 84° N
3. 96°, 21° SE
15°, 24° NW = Bedding on siltstone

80 - 197

5/6/80 Traverse from Core Trailer across upper N slope of damsite and back to Watana camp.

80 - 198

Gy green rock with phenocrysts or grains of plagioclase (weathered to a rusty color) of hornblende, and clastic fragments of what appears to be argillite. Numerous undifferentiable grains are dotted throughout the rock as well. It is quite possibly an andesite or a volcanoclastic metasedimentary rock. Outcrop is 15' high and 15' wide. Possible bedding planes at 343°, 57° NE. Also noticed cobbles of diorite in this outcrop lending further credence to a [illegible] of volcanoclastic metasedimentary origin.

80 - 199

Grey to yellow orange partly decomposed quartz diorite med. to coarse grained. Feldspars in this outcrop are altering to clay mins, and there is a lot of Fe Ox stain. Qtz grains are numerous and large and

[illegible] 20' long and [illegible] [illegible] [illegible]

7/12/80 [#3, 56]

Devils Canyon - general reconnaissance, traverse locating etc.

80-204

light grey to mottled white, med to coarse grained igneous rock. CI ≈ 20%. Albite is predominant mineral. - Biotite is predominant mafic - large qtz grains. - Biotite qtz diorite or Granodiorite. Hand specimen taken

1 317°, 84° S
2 260°, 90°
3) 290°, 77° N

80-205

light grey biotite granodiorite - 20% qtz recrystallized. C.I. ≈ 20 - predominantly albite but a lot of calcic plag. is also present.

1. 303°, 90°
2. 348°, 90°
3. 50°, 69° SE
4. 116°, 55° NW

the diorite at this outcrop has a pinkish cast to the [illegible] and looks similar

to some of the diorite at the watana dominate.

80-206

Dark grey graphitic looking phyllite iron stained on weathered surfaces with occasional concentrations of secondary pyrite.

1. 76°, 58° SE - Plane of Bedding
2. 52°, 47° NW
3. 310°, 66° N
4. 305°, 76° N

80-207

Dark grey graphitic looking phyllite - FeO_2 stain on weathered surfaces, pyrite cubes. Quartz as fracture fillings.

1. 320°, 64° S
2. 330°, 60° NE
3. 288, 40° SW IV
4. 62°, 84° SE
5. 350°, 78° SW. I
6. 74°, 74° S
7. 164°, 17° NE IV

II

80-208

Dark grey graphitic looking phyllite

1. 56°, 77° SE II
2. 345°, 80° NE I
3. 125°, 62° S
1. 48°, 79° SE II
5. [illegible]°, 74° NE

-209

Dark grey graphitic looking phyllitic to [illegible] rock - does not [illegible] cleavage planes as well as [illegible] should. It tends to be more blocky and massive. Otherwise it bears a very close resemblance to the phyllites above, - conchoidal fracture

1. 52°, 54° NW
2. 323°, 84° NE
3. 109°, 37° S

80-210

Dark grey meta-argillite to meta ss. secondary pyrite - massive and blocky - as at #209 also

1. 340°, 77° NE conchoidal fracture
2. 26°, 72° E
3. 60°, 40° SE

80-211

Dark grey meta argillite as at #210 Blocky, massive

1. 342°, 32° SW
2. 73°, 32° SE Bedding Plane
3. 4°, 64° W

80-212

Grey meta sediment, probably a meta siltstone or fine gr. ss. - conchoidal fracture is evident upon breakage. - Massive & blocky

1. 35°, 84° W
2. 305°, 36° S
3. 86°, 32° S

7/13/80 [#3,57]

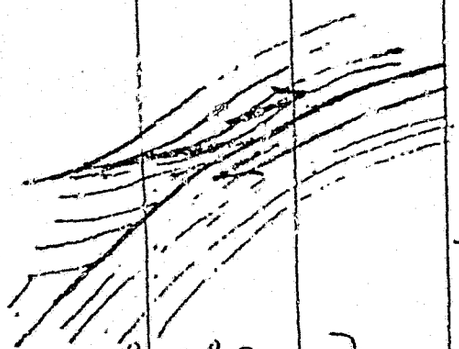
Fog creek reconnaissance and mapping

80-213

Dark grey metasedimentary rocks [illegible] metasandstone argillite to [illegible] — also noted a [illegible] marble, all surfaces [illegible] the exception of the possible [illegible] primary joint and shear is ⊥ to the plane of bedding

1. 126°, 78° S
2. 122°, 72° S } Primary Joint
3. 135°, 85° S

4 23°, 63° W — Plane of bedding



← low angle bedding plane thrusts as well as a major shear [illegible] ⊥ to these

5. 12°, 50° E } Primary Joint
6. 552°, 53 NW

214
215
216
217 } I took measurements and Mike took notes

80-218

This outcrop is ≈ 70' high by ≈ 250 long and is composed of alternating [illegible] siltstone, sandstone, limestone all surfaces except the [illegible] are darkly FeO stained. I noted pyrite and charcopyrite in a specimen of siltstone and also noted secondary [illegible] in the same specimen. Bedding of these units lies at ≈ 47°, 44° NW.

80-219

Brn metavolcanoclastic – or tuffaceous meta-sediment – zeolite mineralization after devitrified volcanic glass. Rel. low spec. gravity – weathered to a gravelly soft badly fractured material.

WSD-220

Red metavolcanoclastic w/ black clastic fragments of epidote, the vesicles in the epidote are mineralized w/ zeolites and in places epidote and minor actinolite also appears at the outcrop. It is fine grained lapilli and ashy tuff.

WSD-221

Outcrop is 10' high and 75' wide at extreme [illegible] This is here a [illegible] metagabbro slate [illegible] [illegible] to weathered. There are distributed [illegible] some of which appear [illegible]

WSD-222

Volcanics near site # 220 [illegible] metatuff.

WSD-223

Dk Grey dev. recrystallized argillite w/ [illegible] crystals of hornblende in a [illegible] as well as some distinct size shards of [illegible] fine grained.

1. 283°, 58° NW
2. 295°, 56° S

8-14/80 — looking for Kag 11 bgd contact a[illegible] Fog Creek. (65)

W-80-224

Med. grained biotite granodiorite to qtz. diorite. C.I. ≈ 20% Bcz ≈ 15% - feldspars predominantly plagioclase. Weathers fairly massive & blocky, no strong shearing to evident at this location. Outcrop is ≈ 200' long and 100' high. I did not examine the top of the outcrop but examination of talus revealed that it was consistently the same as described above.

1. 24°, 86°E ≈ 6" to 3'
2. 310°, 75°N ≈ 1' to 3'
3. 327°, 68°SW ≈ 1' to 3'
4. 357°, 42°NE ≈ 8" to 2'

W-80-225

Med grained biotite qtz diorite to Granodiorite weathers blocky and massive - C.I. ≈ 25% Outcrop is 400' long and 100' high. There are no large apparent shear zones at this location but a few small cataclastic zones were noted less than 1" wide at 114°, 47°S.

1. 17°, 78°W 2" to 1' 4306, 58°N
2. 292°, 73°N 2" to 1'
3. 104°, 28°S 2" to 1'

W80-226 -

Dark grey metavolcanic argillite.

1. 310°, 90°
2. 59°, 80°NW
3. 296°, 22°N

} ≈ 4" to 2'

W80-227

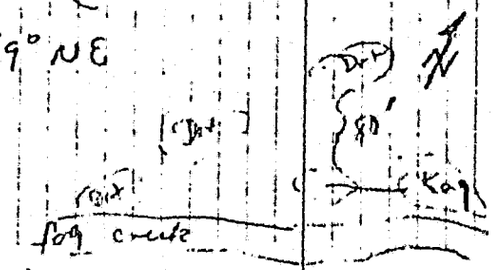
Med grained pinkish grey biotite qtz diorite, outcrop is 35' wide and 50 feet high. This diorite weathers massive and blocky - no slickensides or shear zones are evident.

1. 67°, 53°NW 6" to 1.5'
2. 24°, 25°SE 6" to 1.5'
3. 303°, 80°S 8" to 1.5'

W80-228 -

Dark grey metavolcanic argillite on Fog cr. w diorite outcropping 80' above upslope. See 90, 227

1. 73°, 58°SE
2. 345°, 69°NE



No major shear [illegible] on the above slope but veg. [illegible] Outcrop between Dr and Kag

W-80-229

Dark grey meta volcanic argillite. Outcrop is 15' wide 30' high.

1.) 82°, 42° NW - Plane of bedding
2.) 4°, 90°
3.) 73°, 42° S

W-80-230

Pinkish grey med gr. biotite diorite to granodiorite - C.I. ≈ 30 This outcrop is ≈ 25' high and 50 feet long.

1. 116°, 53° S 6" to 1.5'
2. 86°, 54° SE 1' to 2'
3. 87°, 90° 6" to 1.5
4. 110°, 82° NW

W-80-231

Greyish Pink med gr biotite diorite to granodiorite C.I. ≈ 20. This outcrop is ≈ 50' long and 20' high.

1. 354°, 90° 6" to 2'
2. 86°, 68° SE
3. 316, 25° NE

[illegible] look at outcrops (68)
south of [illegible] mean, as well as cont. Resonance,
Page #66 book #3

W-80-199 Continued

At this location there is a nonconformity between the meta argillite and the biotite diorite. The argillite displays grain linearity and in places a phyllitic to an almost schistose texture as the development of platy minerals increases from micro to macroscopic. The color of the argillite ranges from a dark grey to a reddish grey to an almost white color. As one proceeds away from the contact and into the argillite the degree of mineral linearity decreases and the meta argillite breaks with a conchoidal fracture. The biotite diorite is actually a biotite qtz diorite at this location possibly due to the assimilation of large quantities of qtz rich meta argillite. The diorite displays flow lineation near the contact with the meta argillite, and there is a distinct shear zone ≈ 4" to 1' thick between the two rock types. This shear zone is oriented at 77°, 83° NW

Bedding of the meta argillite is 83°, 73° NW.
Up section in the meta argillite above the zone of emplacement of the main body of diorite. The argillite is reddened with sills, ranging in width from less than an inch to two feet. These sills exhibit chilled border zones and are often very quartz rich at the contact, often time massive quartz forms the contact between the diorite and the argillite. Numerous lenses and stringers of quartz also pervade the meta argillite itself. Numerous xenoliths of meta argillite in various degrees of assimilation appear in the diorite some appear only as shadows having been almost completed absorbed by the diorite.

Joints include

1. 310°, 57° SW	1" to 1'
2. 73°, 28° SE	4" to 25'
3. 78, 27° SE	" " "
4. 325°, 90°	1" to 1'
5. 85°, 27° SE	4" to 25'

W-232

Dark grey meta argillite - massive w/ some rudimentary grain linearity developed. In some layers the meta-argillite has a reddish maroon cast to it. There are some quartz vein fillings and quartz stringers within the argillite. The bedding orientation of the meta argillite is 43°, 62° NW

Joints

1. 18°, 39° E
2. 237°, 80° S
3. 80°, 76° NW
4. 33°, 86° W
5. 355°, 48° NE
6. 40°, 88° NW

233 In Mikes Notes

234 In Mikes Notes

235 In Mikes Notes

W80-236

This outcrop is deeply iron stained and very decorsely jointed and fractured.

1. Medium grained mesocrystalline biotite, hornblende granodiorite - C.I. ≈ 18, qtz ≈ 15%.

2. Fine grained almost aphanitic siliceous rock - probably a late stage residual liquid off of the granodiorite which passed into fairly cool rock and was quickly cooled.

There are numerous shears cross cutting this outcrop some of them display thick clayey gouge zones from 1" to several feet in thickness orientations on these include

1. 82°, 44° NW
2. 78°, 58° NW

Some joint orientations include

1. 12°, 87° SW <1" to 1.5'
2. 295, 52° S " " "
3. 95°, 37° S " " "
4. 315°, 75° SW " " "

Another large shear zone is evidenced by a wide clayey gouge zone. All the rock in and around this zone has been deeply iron stained and altered by sulphur. The host rock is [illegible] granite and all the [illegible] has been [illegible] to clay. Only the quartz remains where [illegible] the rock. In places along these shear zones pyrite forms large continuous layers up to 3/8 inch thick. What appear to be gypsum crystals are developing along these shear zones and form thin [illegible] on the rock. Orientations [illegible] shear include

1. [illegible]3°, 4[illegible]° NW
2. 290°, 60° NW
3. 98°, 62° NW
4. 99°, 62° NW - Slickensided surface

Another large shear zone lies at 115°, 52° N, the shear zone itself appears to be ≈15' wide and [illegible] gouge w residual quartz [illegible]. Interlayered with the gouge are smooth slickensided surfaces of mylonite. This whole gouge

zone is very sulphurous and pyrite exists in layers with the mylonite zones. Slickensides dip 20° W

Other joints include

1. 310°, 74° SW

Another large shear 4' to 8' wide is located at 350°, 74° NE. - Mylonite zones are present throughout this shear

W-237 -

Greenish Brown pink - biotite hornblende qtz. Granodiorite CI=15. Weathers to a Pinkish grey. Slightly iron stained on some joint surfaces. Heavily jointed.

Joint orientations include

1. 348°, 83° NE
2. 350°, 77° NE
3. 92°, 57° S
4. 6°, 57° W
5. 20°, 78° W
6. 297, 68° SW
7. 350°, 60° NE

W80-239

Light grey biotite granite to Granodiorite qty ≈ 25 to 30%. Masses of chlorite also appear within this rock - CI ≈ 15. Appears partially recrystalized - med gr. microcrystaline. P_2O_5 stain on some zoom & surfaces. Weathers to a pinkish grey. Because this rock is microcrystaline it is difficult to get a positive fix on the feldspars

W80-240

Dark grey to Green Black - Aphanitic groundmass w/ phenos of plagioclase and pyroxene - ie. Porphyritic basalt. Weathers to a Dark green grey, Massive. Outcrop is ≈ 20' long and 20' high. Very few vesicles or fractures but those that exist are filled by calcite or zeolitic material

W80-241

Pinkish grey biotite, hornblende granite to granodiorite, CI ≈ 10 to 15 qty ≈ 75%. - feldspar is predominantly Kspar. Weathers to a greyish, whitish pink outcrop is massive

1,356°, 45° NE
2,8°, 65° SW
3,85°, 52° NW

8/29/[illegible] Fog Creek [#3, 87]

W80-247 Green grey Till: - Matrix is sandy silt w/ some clay - crse grave w/ 15% cobbles & boulders. Striations on almost all cobbles. Moderate Plasticity rolls to 1/8 inch.

W80-248
Grey brown Till - lots of striations. Matrix is silty sand w/ some clay.

W80-249
Grey green to grey maroon - meta argillite - baked and highly fractured w/ some sulphides mainly Pyrrhopyrite. Weathers to med grey green w/ FeOx stain on some joint surfaces and yellow sulphur stain on some surfaces. What appears to be gypsum is [illegible] on the outer [illegible] of the outcrop [illegible].

Tests
1. 25°, 89°C
2. 330 - 70° NE
3. 78, 66° NW
4. 25°, [illegible]

10-3-80

Watana elev. [illegible] @ 8° C

Things to do:

1) Sample till in Deadman
2) Sample till in Watana Ck.
3) Sample rock @ Quarry "A" and "Fins"
4) Fly runway
5) Fly Watana Damsite
6) Photograph Tbgd
7) Fly Devil Canyon in the canyon
8) Area alluvium

Temp is 28°F at 8:28

Flight along Watana Damsite

Numerouse fresh slides accross the Su from Tsusena creek (about 1/2 mile East of Tsu. Creek.)
- line of depressions at base of hill east of Tsusena creek. - Possible old meander?

Some fresh slides along left abutment.
- No observable bedrock just east of the fins and extending several hundred feet before bedrock is again exposed.
- No observable bedrock just west of deadman and extending for several hundred feet.
- however bx is exposed at least ≈ 1/2 the way up the slope but possibly not above!

Fresh slide in second creek to the east of the Fins

- Runway - needs to be leveled off at western end - little fill in area near camp and - leveling and filling at eastern end.

Devil's Canyon fly key

- Very close near vertical joint near pinnacle blow core, shock ≈ N-S also sub horizontal sets - looks bad,

SUSITNA
HYDROELECTRIC
PROJECT
P 5701.05

BOOK #3
1980

BRUEN

P 5701.05
AAI WATANA B #3
M.P. BRUEN

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JOINT SET MEASUREMENTS 140-155

8-3-80
[#2, 21]

It's mostly overcast this morning and to the north, near or north of the Alaska Range it is clear. Will begin working by getting dropped at the knob opposite the Fins, and work as far downstream as we can on the left abutment.

Watana

226[illegible] @ 6[illegible] @ 51°
@ 8[50] @ 58°

Three Rivers Union #127
Akland #165

W-80-137

An amber-gray inequigranular hornblende quartz diorite. Medium to coarse grained and is only partially stallized. Fairly broken-up outcrop, small and just above the river cliff. Sampled

Elev. 1556' @ 9[38] @ 59°

N-80-138

Xtalline gray, slightly metamorphosed diorite. Slight recrystallization. Has a funny texture. Hornblende quartz diorite. Possibly incipient shears... Sampled, see 80-137.

Elev. 1644' @ 10[20] @ 68°

Joint:

290°	88° N	2'
275°	86° S	
275°	86° N	
306°	15° NE	~3'
66°	80° SE	
347°	86° E	~3'

Weathered surface has plagioclase phenocrysts which stand out. This resembles the porphyritic andesite. We checked the previous site where we thought we had

porphyritic andesite, but its not.

N-80-139

Medium to coarse grained diorite. Mostly plagioclase, with biotite and hornblende for ferromag minerals. CI = 20%. Diorite is white gray with some green. We are right on the Smoitin, talus slopes on both sides of the outcrop. Outcrop is ~15' high & ~25' across

Joints 332° vert

262°	76° N	
332°	vert	~4'
354°	2° E	

1455' @ 11[18] @ 60°

Talus slopes are very angular blocks, 1'-3' in diam.

W-80-140

White gray quartz diorite. Can see quartz in this outcrop, also lots of plagioclase, and some biotite and a trace amount of hornblend

Joints:

250°	74° N	1'-3'
56°	78° NW	
85°	77° N	8"-2'
277°	37° SE	3"-1'
323°	90°	8"-3'

Outcrop is approx several hundred feet long and >60' high, cliff

Elev 1465' @ 11[39] @ 60°

W-80-141

White-gray medium grained biotite rich diorite. At edge of a cliff 30' above the river. Talus in this diorite

Joints:

23°	31° W	6"-2'
317°	63° NE	1'-2'
318°	66° NE	
54°	85° SE	1'-2'
x 315°	85° NE	

major cliff face

W-80-142

White-gray, medium grained diorite, biotite rich. No quartz was seen.

Elev.

1544' @ 12[42] @ 60°

Joints

250°	81° S	24'
310°	75° NE	
55°	90° NW	4"-1'
115°	33° NE	2"-1'
17°	vert	
322°	35° NE	
40°	90°	

R&M survey marker for
SL-80-3, base of cliff on left abutement
Elev 1533' @ 1^07 @ 61°

W-80-143

Green-gray fine to medium grained partially xtallized xtalline diorite. Finer grained than most of the diorite. Resembles that which was seen at the knob earlier today (opp. the "Fins") The diorite here has undergone low-grade metamorphism The diorite is v. hard.

Joints

318°	90°		
330°	86°	NE	~2'
244°	84°	NW	
270°	84°	NW	
0°	65°	W	~1'-3'
92°	80°	N	~6"-1½'

Watana
2238' @ 2^58 @ 60°

All along the Susitna River on the left abutement there are rock exposures and talus slopes with only a thin veneer of soil and vegetation.

Took a picture of the slump which ended up in the river. Also pictures looking upstream and downstream of river from Quarry "B".

8-4-80
[#2, 23]

It rained last night, but the weather is clearing, breaking up.

Watana 2262' @ 7^{35} @ 62°
Dun and I will work the right, abutment from the "Fins", upstream towards Deadman Creek, along the river

W-80-144
An amber-gray green to blue green inequigranular hornblende diorite. The rock has undergone recrystallization and appears to be transitional between a diorite and an andesite. The rock resembles that which was seen on the knob opposite the "Fins". This outcrop warrants a thin section.
Elev. 1442' @ 9^{45} @ 61°

Dun got some joint measurements

W-80-145
A white-gray-black biotite diorite or quartz diorite. It appears that there is some quartz in the diorite. The diorite is medium to coarse grained. The outcrop is approx. 25' high and ≥ 40' across

Joints:

115°	79° S
125°	67° N
345°	74° S

Elevation:
1580' @ 10^{42} @ 62°

W-80-146

A medium to coarse grained, whitish-gray-black, biotite rich diorite. The outcrop is ~20' high and ~40' long, at least. Weathers rough, pitted surface due to differential weathering, plagioclase weathers out first. Grainy texture with a green-white,-gray weathered surface

Elev. 1573' @ 11° @ 62°

Dan has taken some joint measurements.

Joints:

90°	82° N
63°	88° N-NW ~1'
308°	30° S-SW ~3'
311°	67° S-SW

W-80-147

A medium to coarse grained white gray-black diorite. ~~cont~~ The diorite is biotite-rich, some hornblende and possibly quartz. Weathers to a whitish-gray.

Elev. 1494' @ 12° @ 62°

Joints:

60°	80° NE ~1'
283°	25° S ~3'
349°	vert
335°	80° NE

W-80-148

A medium grained whitish-gray biotite rich diorite. Weathers to a yellowish white (plagioclase) and black surface which is pitted. No quartz was seen. The outcrop is a combination of the last two stops. We are walking along the base

of this cliff. It's at least 30' high. Some black staining probably due to organic zone above

Elev. 1531' @ 12^{48} @ 67°

302°	58°	S-SE
48°	75°	SE
266°	86°	N
10°	17°	W
118°	27°	S

Small fractures which show have slickensides.

W-80-149

White gray, biotite rich diorite, medium grained but finer than we have seen in the last few outcrops. CI ≈ 20%. Not as many ferromags here. Outcrop is approx 15'-20' high and ≅ 80' across. Didn't see any quartz.

Elev. 1603' @ 1^{30} @ 67°

Joints:

27° 77° E

see Dan's book.

Highly fractured zone in this outcrop but no movement can be detected.

W-80-150

A gray (some black) medium grained biotite rich diorite. No quartz was observed. The outcrop is located on the sides of a "V". A snow avalanche has made a clearing adjacent to this site.

Elev. 1638' @ 1^{55} @ 69°

The outcrop is approx 100' above the Susitna

W-80-151

Gray (black), medium grained, biotite rich diorite outcrop with a finer grained felsic dike. The felsic dike has a high quartz content, has a low CI, ≤10%, and has a slight sugary texture. Could the result of latter activity within the diorite complex. The fine-grained zone or dike is more heavily fractured and is approx 2' thick. Outcrop is about 15' high and 20' wide. Sampled here.

Joints:

285°	68° SE
35°	62° W
21°	59° W

The silicous dike is weathered to a pale yellow-white color.

Elev. 1723' @ 2.28 @ 68°

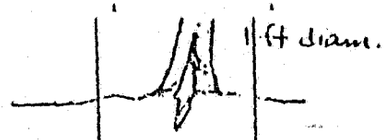
Flagged to verify the location

W-80-152

A slump on a SE facing slope. The slump is approx. 150' long, 30' across, and 5'-10' deep. Check to see if this was on the 1978 photo's. It appears to be recent as there is no vegetation in the scar. The material ranges from a bouldery, sandy silt and a bouldery, sandy clay. The diorite (co. grained) boulders have or are decomposing and this have caused the plagioclase to weather to clay. The clay is an orange brown color and there is also a layer of whitish-gray pebbly, silty clay or clayey silt which resembles the breccia zone found in BH-2. Most of the boulders are angular with some rounded, no striations can be seen on the boulders.

Elev. 1747' @ 3.09 @ 66°

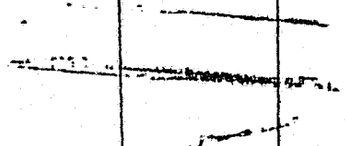
Alot of water is draining out of this scar.



Tree split due to slope movement

W. 80-153

Gray (black) medium grained biotite rich diorite or quartz diorite. Hard to see some quartz so I would presume that its a quartz diorite. Numerous ¼' - 2' highly siliceous, fine grained white-gray dikes or filling with a sharp contact, see the sample. The dikes are sub-horizontal.



dikes in outcrop
X-section

Elev. 761' @ 3'E @ 70°
Flagged

W-80-153

Outcrops along a chute opposite the small island in the Susitna River. Dam is doing the east side and I'm doing the west side. A white-gray (black) medium grained, biotite-rich quartz diorite. CI = 30-35%. Some quartz is visible with a hand lens.

Elev 1626' @ 4'E @ 69°

Joints:

	0°	vert	
dominant	318°	56° NE	6"-1'
	310°	63° SW	~1'

In places the diorite is decomposing, breaks into granular pieces.

W-80-154

On the Susitna River outcrop of rock from here upstream for a way. A gray (black) medium to coarse grained biotite rich quartz diorite. Weathers to a pale white, pitted surface. Outcrop is 10' high cliff on river bank.

Joints:

43° 79° SE

322°	61°	NE	1'-2'
312°	60°	SW	~3'

Dan took measurements ~60' above the water from inc. same number.

W 80-155

Outcrop of yellow orange weathered biotite-rich quartz diorite at the edge of a talus slump. There is a shear zone ~1' wide which has numerous small shears. This has resulted in decomposition of the diorite, breaking into small granular pcs.

Joint

50°	45°	NW
320°	70°	NE

Shear zone

298°	77°	N-NE

We are only 25' above the river

W-80-156

Dan was at a small outcrop on the River

W-80-157

A gray (black) medium to coarse grained, biotite-rich, diorite. Didn't see any quartz so I'm unsure as to weather its quartz diorite. Outcrop is right on the river.

Joints

52°	78°	NW	~1'
330°	55°	NE	~3'
42°	50°	SE	
328°	67°	NE	
50°	47°	SE	
318°	22°	SW	~3

W-80-158

An outcrop on the river edge
25-35' high and [illegible]
A gray (black) biotite rich diorite
Outcrop has good parallel jointing

Joints:

68°	85° vert		
312°	55°	NE	1'-6'
302°	30°	SW	1'-3'
65°	75°	SE	1'-3'

Watana
2155' @ 11⁰⁰ @ 43°

Finished our traverse @ 6³⁰.
Decided to try and flag a helicopter rather than climb the cliff and walk back to camp. We ended up waiting till 9⁰⁰ before the helicopter came out looking for us and found us.
12 hours.

pns.

8-5-80
[#2, 28]

It's a beautiful clear morning. Today Dan will work in the camp on plotting the outcrops and point locations of the past few days. He will use the stereoscope pairs for accuracy and additional outcrops. Larry and I will work west and southwest of Quarry A, using helicopter support to get stations on the outcrops. We have approx. 5 hours of helo. time.

Watana 2262' @ 8²⁰ @ 65°

W-80-159

Green with some dark green-gray fine grained andesite w/ very small and very few plagioclase phenocrysts. Phenocrysts are ≤1mm in size, no quartz can be seen. Outcrops are scattered on the edge of this small pond.

harry has elev.

Joints.

320°	75° E
~80°	23° S
62°	32° S-SE 6" to ?

Observed one large pc of medium grained quartz diorite. Can see quartz, plagioclase, biotite, and possibly some hornblende. Its at least 10" across, well rounded and there is a sharp contact between the two rocks

357°	86° W	6"-3'
100°	77° N	6" to 1½'
99°	70° N	

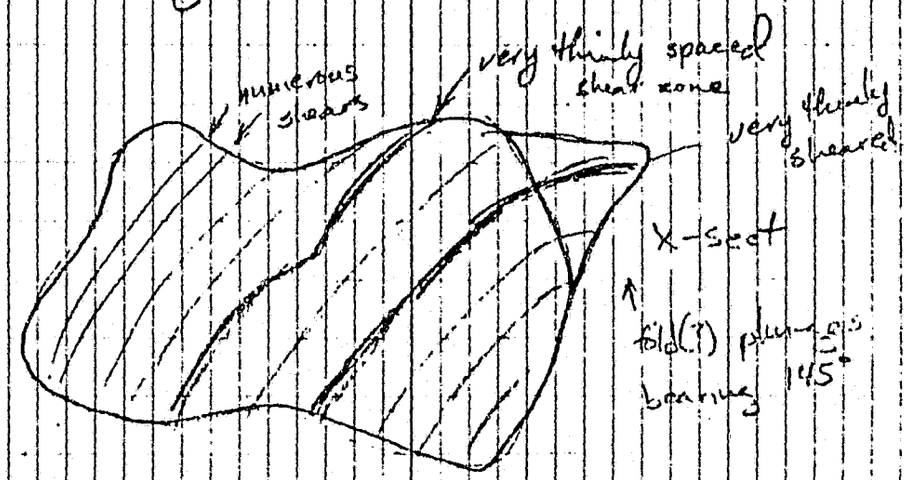
Picture 112

W-80-160

A gray (light to medium), fine grained sandstone or meta-sandstone. Weathers to a gray or brown yellow color. This outcrop is fairly rotten. Outcrop is exposed on a break in slope next to a marshy area w/a small pond.

Striations on a flat polished rock above, bearing 262°, but may not be in place. The outcrop is fairly rotten and fractured. Shearing has occurred here

	262°	45° N	
shearing →	28°	74° E	1"-3"
	342°	75° SE	1'-2+
possible bedding	73°	35° S-SE	



2355' @ 11° @ 69°

Seems to have thin veneer of till on top of this outcrop. Saw a large rounded boulder (~10" long) w/ striations.

So:
For the most part, all the rock is rotten, where exposures are visible along this break in slope. In working west we may have crossed over into the andesite but it appears the rock still has a granular texture. Have Dan look at the rocks. Sampled.

W-80-161

A large outcrop on the south side of the pond, 20' high 60'-80' across. It is a very hard, fine grained dark green-gray andesite. No phenocrysts and the texture is to fine to enable mineral identification. See plagioclase and biotite or hornblende.

Elev. 2278' @ 12^38 @ 67°

Joints

279°	87° N
290°	69° N-NE 3'-8'

Has a thin horizontal layering of ½"-2". Expansion jointing. Weathers to a gray (medium) color.

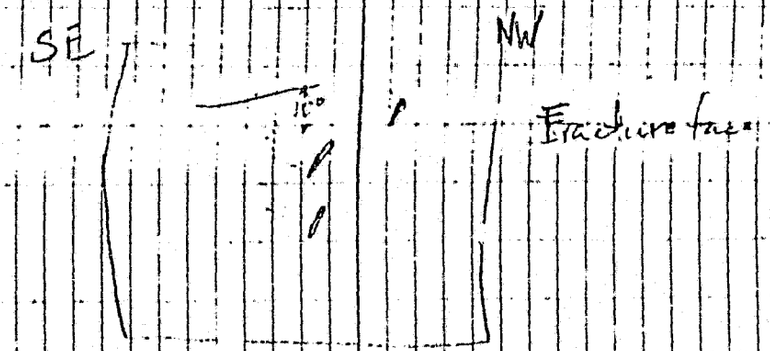
Traversing south edge of this lake (161, 162, 163)

W-80-162

Dark gray, fine grained andesite basalt to basalt. Aphanitic texture. Outcrop is 15' high and 60+' long. Slickensides are visible on one joint face.

Slickenside fracture plane - Joint
55° W or 305° 83°-85° N

For slicks at 10° to horiz. mostly very fine wispy slicks



Joints:

22°	77° E	
357°	20° W	1'-2'
290°	85° S	

W-80-163

West end of pond. A dark gray-to gray-green fine to medium grained andesite. No phenocrysts. Larry is looking at an outcrop on the edge of the pond and I'm upslope from him, ~200'. Appears to have small pcs. of argillite.

Elev. 2325' @ 137' @ 68°

Joints:

290°	82° N	
330°	40° SW	1"-1'
318°	53° NE	

W-80-164

Dark green gray slightly porphoritic andesite basalt to basalt. Outcrop has a 2mm weathering rind. Interior to a medium gray. Phenocrysts of plagioclase ≤ 1mm.

Elev. 2359' @ 1SE @ 70°

Joints:

52°	60° SE	
350°	80° E	
330°	88° NE	
22°	53° W	1'-
40°	77° NW	
17°	74° W	1'-2'

W-80-165

Green aphanitic andesite. Larry has found the andesite to be porphoritic on an adjacent outcrop. Outcrops are on opposite sides of

the notch on this knob. Andesite weathers to a medium gray to buff gray color.

Elev. 2521' @ 2^{27} @ 71°
of notch, low

Joints:

298°	32°	S-SW	6"-1'
43°	55°	SE	
37°	88°	NW	10'
330°	59°	SW	

On the knob on C_____ Land.
Outcrops were each ~ 10' & 20' long.
The whole knob is bedrock, mostly covered by a thin vegetation mat.
Have frost boils on this knob; material is a silty sand, ~ 12" in diameter

W-80-166

A medium to dark gray slightly porphoritic rock with some small plagioclase phenocrysts. A nice waterfall here

Elev. 2211' @ 3^{12} @ 72° near top
2163' @ base @ 3^{18}

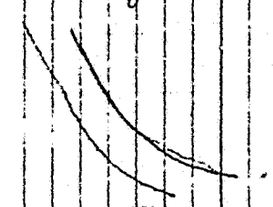
Joints:

309°	74°	SW	
38°	49°	S-SE	8"-1'
324°	78°	NE	~1'+
35°	37°	SE	

The outcrop is ~ 75' high and ~100' across. Andesite varies to a green porphoritic andesite with plagioclase phenocrysts.

341°	75°	NE-E	1'-3'
10°	27°	E	

Some joints are curved* and look as if there was a thrust but there is no geologic evidence. See Larrys



notes for additional joint measurements

W-80-167

A medium gray, fine grained, aphanitic andesite or andesite basalt plagioclase, some biotite. Outcrop is on the edge of the knob adjacent to the small pond. Outcrop weathers to a pale green (groundmass) off white (plag phenocrysts). who

Elev. 2186' @ 3^{52} @ 75°

Joints:

95°	73°	S
324°	67°	SW
348°	88°	NE
8°	12°	E

Watana
2312' @ 5^{00} @ 72°

On the south edge of the knob Larry found a small outcrop of fine grained dioritic rock, biotite rich. Fairly insignificant at this time.

Ended up getting just about the whole area covered, except for the knob just north of Fog Creek. Should plan on making at least one stop there. Also there was one outcrop that was a sandstone. The sandstone is bordered to the east, west and south by andesite. At the present time, this small window in the andesite is insignificant. It may warrant rechecking if the sandstone could be used for lining up the sandstone on the Susitna with that which may be found on Fog Creek.

8-6-80

Dan and Larry are doing a traverse along the Susitna on the left abutment. The traverse will begin from just opposite the "Fingerbuster" to the bend in the Susitna where it starts to flow south. J. Gill and J. Lawrence will be in camp. Dan will use this field book.

[#2, 36]

8-6/80

80-168

- Gy, Green biotite diorite - C.I. ≈ 25%
outcrop ≈ 200' long - 50' high
evidence of a brecciated shear zone on cliff face - weathers with a rounded, irregular surface.

1. 114°, 73° N. (6" to 1')
2. 10°, 62° NE (6" to 1')
3. 100°, 21° N (2" to 8")
4. 80°, N 47° NW
5. 50°, 69° E (2" to 1')

80-169

Dark grey - porphyritic basaltic andesite, phenocrysts of plagioclase.

1. 30°, 72° E
2. 60°, 21° SE
3. 120°, 90°
4. 355°, 90°

Outcrop approx 100' high and 100' wide - surface of this andesite weathers fairly smoothly with depressions after plagioclase.

80-170

Grey Green porphyritic andesite - phenocrysts of plagioclase and disseminated clasts and shadows of and after partly recrystallized argillite.

1.) 70°, 84° NW
2.) 62°, 84° NW
3.) 355°, 77° NE
4.) 35°, 15° NW
5.) 120°, 82° SW

Outcrop is 6' high and 15' wide - right at rivers edge.

80 - 171 -

Gy Green hornblende Diorite partly recrystalized w/a sight pinkish dust to some of the feldspars (not orthoclase) but plagioclase, - Outcrop weathers with a coarse granular texture. Outcrop is ≈ 60' high by 20' wide.

1. 8°, 80° NE (6" - 1.5')
2. 337°, 30° NE (2" - 1.0')
3. 84°, 77° NW
4. 305°, 25° N
5. 340°, 68° NE

80 - 172

Gy Green porphyritic andesite w/phenos of plagioclase and numerous clasts of diorite and some of argillite

1. [illegible], 78° NW
2. 320°, 78° NE
3. 315°, 15° [illegible]
4. [illegible], 71° [illegible]

80-173

Gy Green porphyritic Hnd. w plag phenos and a couple of small secondary pyrite cubes. weathers with a smooth rounded surface outcrop 3' to 15' high and 25' long - on river.

1. 85°, 90° (6" to 1')
2. 120°, 86° N
3. 58°, 20° NW

Hand specimen taken at this location

80-174

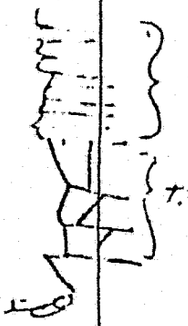
Grey green - rock - in places resembling andesite and in others a well indurated ss. or greywacke, possibly a zone of contact between the two rock types with a distinct shear zone present. some recrystalization has taken place

1. 70°, 88° [illegible]
2. 275°, 75° NW
3. 85°, 33° NW
4. 285°, 99° N
5. 33°, 84° E

Outcrop is 25' long - 20' high. Hand specimens taken

80 - 175

Gr. mottled with buff colored clasts greywacke - clasts of feldspar, argillite, quartz - fine to coarse grained - well graded. Hand specimen taken.



outcrop = thin beds, thicker beds

4°, 11° NW c. orientation of bedding.

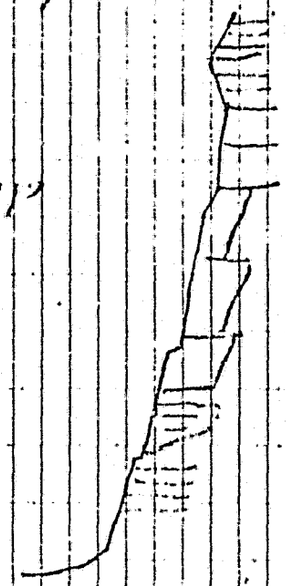
outcrop = 100' long 5' high to 35' high

1. 270°, 63° SE
2. 34° 36 NW
3. 18°, 78° E
4. 50°, 13° NW
5. 55°, 73° SE.

80 - 176

Gr to bn well indurated partly [illegible] argillite and greywacke. [illegible] two rock [illegible] are distant and well defined in [illegible] they are swirled together suggesting possibly submarine slumpage or turbidity currents.

Hand specimen obtained



outcrop

89°, 14° NW = orientation of bed.

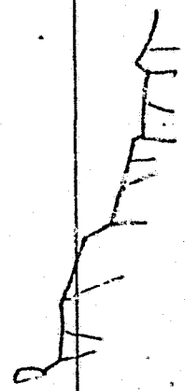
1. 317°, 85° N
2. 304°, 64° N
3. 2°, 90°
4. 120°, 32° NW
5. 320, 8° N

80 - 177

Green clastic metasediment w/ clasts, fragments of quartz (possibly volcanic in origin) feldspar, and possibly argillite.

Over

outcrop weathers massive and blocky.



1. 305°, 89° S.
2. 355°, 70° NE
3. 87°, 65° NW
4. 314°, 85° NE
5. 88°, 68° NW

80 - 178 -

Gy-green clastic metasediment w/ dark gy to black clastic fragments - probably a tuffaceous sandstone or tuff.

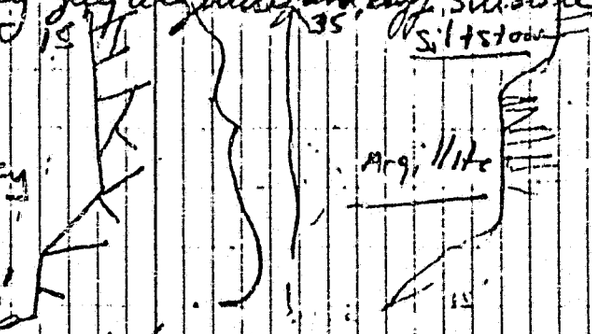
outcrop massive to blocky

hand specimen
1. 80°, 72° SE
2. 315°, 89° NE

3. 300°, 76° W
4. 50°, 89° SE

80 - 179

Dark gray volcanoclastic metasediment or tuff overlain by gray argillite and buff siltstone,



weathers massive & blocky

Hand specimen taken

1. 340°, 70° NE (6" to 8")
2. 95°, 84° SE
3. 15°, 74° NE
4. 112°, 56° S

80-180

Green to tan siltstone to fine gr. meta-sandstone.

bedding plane orientation
70°, 9° NW

1. 115°, 75° S
2. 60°, 34° E
3. 345°, 28° SW
4. 95°, 27° S

80-181 –

Gy green – clastic metasediment
gr. size ranges from silt through small
cobble size. Larger than sand size ≈ 20%.

1. 1.5°, 75° S
2. 342°, 64° NE
3. 65°, 52° SE
4. 350°, 82° N

80-182

Gy green clastic meta sediment.

1. 290°, 78° S
2. 50°, 70° E
3. 350°, 90°
4. 72°, 78 N

outcrop

80-183

Dark gray green volcaniclastic tuff.
low lying outcrop, Possibly basalt. No
pillow notices
1. 30° S, 90°
2. 260° W, 90°

outcrop

80-184 – Basalt ? or volcaniclastic ?
not possible to obtain orientation due
to rounded weathered surfaces.
~~Some evidence for pillows in the basalt~~
~~as exposed at river level?~~

8-7-80
[#2, 50]

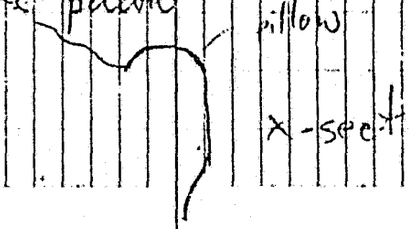
It is cloudy and raining out this morning. Will finish up the traverse between where Dan and Larry left off yesterday and where I started. This is the left abutement across from Borrow "E" (80-189 to 80-193). Then Dan and I worked just upstream of the Tsusena Creek and the Susitna confluence (80-194 to 80-196). Finally worked in the Deadman Creek area, on both abutements and just upstream of the confluence (80-197 to 80-199)

Urlana
2262' @ 7^{05} @ 49°

W-80-189

Gray-Green, gray aphanitic andesitic basalt with ~~dat~~ medium gray to to green xenoliths. Xenoliths are slightly porphoritic, may be some are porphoritic andesite, porphoritic basalt. Difficulty in determining the compositional make-up and origin of the xenoliths. Groundmass and xenoliths have a vesicular texture. Xenoliths are rectangular with some as breccia

Don't think that this is a tuff based on basalt exposure just upstream and the xenoliths are not graded. Appearance of a possible pillow



Outcrop is 30' across and 20' high, we are at river level. Dan took joint measurements.

W-80-190

[illegible] green [illegible], medium gray basalt, aphanitic. Has small white to clear, probably plagioclase crystals ± 1mm. Some xenoliths in the basalt. Has a small chert vein, we are at the river level. Outcrop is 30' high and at least 60' long. Dan has taken joint measurements. Sampled

W-80-191

Difficulty in determining the [illegible] type here. It could be an altered andesite with clast w/i the rock or a metagrawacke.

It is a green rock w/ clast w/i the groundmass. Outcrop is right in the river, approx 50' high and ~100' across. Don't see any bedding in the outcrop and clasts could be called ~~an~~ xenoliths. Inclusions could it be argillite look like basalt. Groundmass is slightly porphyritic. Took samples. Basalt adjacent to, just downstream of sample, possible fault of graywacke in. Inclusion in basalt ???

W-80-192

Outcrop which sticks out from the banks of the river. Approx 50' wide and 6' above the current river level. Has a pillow texture. Medium to dark gray aphanitic basalt.

Joints	
30°	50° NW
335°	67° NE
112°	60° N
320°	76° NW

W-80-193

An orange-brown weathered surface of the outcrop. The rock is a dark gray aphanitic basalt. Outcrop is at water surface to

Joint

* 295°	70° S	
35°	vert	

~50' above the water. We bypassed a lot of cliff exposure because of accessibility. At 295° bearing large joint face

Bill picked up up and moved us to just upstream of Tsusena Ck on the right abutment

W-80-194

A dark gray aphanitic basalt which weathers to a green-gray or gray-green. Outcrop is on the river ~ 10' high and is exposed upstream of the stratified sand and gravel deposit

Joints:

Major	305°	88°	S-SW } 3'-3'
	316°	79°	S-SW }
Minor	347°	10°	SW

W-80-195

An orange-brown heavily weathered basalt or slightly porphyritic andesite basalt. At this point the basalt has been sheared. There is one minor shear (105°, 90°) which is displays slickensides and is subparallel to the river bend. The major shear (323°, vert) is about 1½ geol hammer length or ~ 28" guess, very heavily

[illegible] and decomposed, mostly gouge. A couple of [illegible] small [illegible] ½ thick [illegible] [illegible] [illegible]

...ties. ...
Bedding of shale
27° 27° W

W-80-197
Medium to coarse grained green-gray diorite
hornblende
Plagioclase, hornblende + possibly quartz
58° 24° SE
355° 74° SW
94° vert.

W-80-198
A mostly rich diorite
Medium to coarse grained. Weathers to a rough granular surface
127° 64° N-NE
25° [illegible] E
50° vert

Outcrop on a [illegible] of Deadman. Small outcrop on the outwash plain

W-80-199
Contact of diorite ~~and~~ with an argillite and siltstone. Diorite has intruded the fine grained rock and has developed some gneissic texture. The fine grained rock is schistose to phyllite. Slicken sides present but not major. There are sills of diorite w/i the Kag. Appears that the Diorite was intruded into the Kag. Also possible non-conformity
Bedding of
[illegible] 75° N-NW

Days synopsis

Downstream of Tsusena Creek basalt flows are exposed and exhibit some pillow structure

The rock exposure along the Susitna just upstream of the Tsusena Creek confluence has a [illegible] volcanic clastics or metasediments which are overlain by basalt which has been sheared.

Upstream of the Susitna-Deadman confluence the rock changes from a diorite into argillite or phyllitic rock (Kag) This still needs to be approx defined

8-8-80

It's cloudy and raining slightly. Dan and Larry are doing a traverse east-west along the Corps trailer. I'm heading over to Borrow site "E" this morning. Afternoon is for air reconnaissance

Wetlands

2262' @ 9.00 @ 50°

W-80-204

Break slope on east end of Borrow site "E" contains boulders up to 18" in diameter are rounded to well rounded Sample taken from below 24"

Elev. 1555' @ 9.50 @ 58°?

The sample is poorly sorted. Flow of crest is 20' above the sample taken

W-80-205

Bluff of alluvium exposure on the right bank of the Susitna just downstream of Borrow site "E". A bouldery - to pebble medium grained sand. Most boulders are not larger than 18' in diameter. Deposit is non-stratified. Sample taken, mostly containing boulders less than 2 inches, the intermediate axis. Samples taken 10' from top and 18' above the River

Fog Creek - air reconnaissance of possible landing sites and outcrops which we would like to visit.

W-80-206 FOG CREEK

Numerous slumps in a cluster on the south side of the Creek. All seem to be over 20' deep at their heads. The cobbles are subrounded to rounded with no angular corners. Striations can be seen on some of the clasts, this is a till. Slump occurs on as gentle a slope as 8°. The till matrix is a sandy clayey silt.

Tsusena Creek - air reconnaissance of landing sites and places (outcrops) which need to be visited.

8-12-80

Page # 61 in book #2

After a weekend off. Dan is doing air reconnaissance of Devil Canyon, looking for rock outcrops, landing sites and traverse routes. I will do air reconnaissance with W.C.C.

Have decided to do both creeks separately. W.C.C. has decided not to do these in detail. In Fog Creek, there are numerous bedrock faults.

8-13-80

Pag # 61 in book #2

It's a cool overcast morning. It looks like it will rain. Will work in Fog Creek today.

2262' @ 7.30 @ 48°

W-80-213

Outcrop of Kag - highly weathered (oxidized) and [illegible]. Some sulfur staining on the outcrop. Weathers to a dark red brown to a yellow or orange brown color (oxidized). Argillite is thinly bedded with some quartz pods and veins within. Kag has also been folded.

Bedding

30°	62°	W-NW
53°	50°	NW

- measurements ≈ 80' apart

shear - major

116°	68°	S
113°	72°	S

- measurements on S facing cliff face, shear

Elev.

1972' @ 8^{54} @ 53°

Bedding on east sides of outcrop

35°	47°	W-NW

Joint

12°	50° E
352°	53° E

allow orange outcrop of argillite

bedding	43°	45°	NW
	40°	62°	NW

W-80-214

Outcrop of biotite rich quartz diorite or granodiorite CI = 20%

Weathers to a white-gray color +

Outcrop on left abutment of Fog Creek

Joints - very blocky outcrop

287°	vert	cliff face
280°	vert	cliff face
282°	78° S	cliff face
sub horz 324°	16° NE 8" - 5'	
128°	11° NE	
348°	82° NE-NE	1'-6'
342°	vert	1'-6'
355°	vert	1'-6'
105°	80° S	
110°	80° S	

Outcrop cliff is >200' long and avg. 20'-30' high

Diorite is medium-grained

W-80-215

Outcrop is a medium grained biotite rich diorite or granodiorite. CI = 15 & 20%. Seems to have a little more calc. plagioclase

Joints

68°	75° SE	
342°	85° SW	6'-3'
330	90°	

W-80-216

Outcrop of mdg. diorite or granodiorite, biotite rich. Outcrop is 40' above the river level

Joints

all major	264°	[illegible]	NE	1'-4'
	333°	74°	NE	4'-4'
	32°	28°	SW	4'-3'

W-80-217

Highly oxidized, small outcrop of the argillite (Kag). Mdk siltstone to sandstone [illegible] difficult to tell, highly weathered. Outcrop on N side of small kinotch

Elev. 2075' @ 11^30 @ 51°

W-80-218

Sandy siltstone with some limestone, also argillite. Outcrop is highly oxidized and weathered. Has a yellow-orange [illegible] some reddish orange. Outcrop is [illegible] long & 70' [illegible]

Bedding

43°	45° NW
41°	62° NW

Elev. 2054' @ 11^55 @ 52°

Thinly bedded and weathered all to hell. Most of residue on the slope

W-80-221

Highly weathered brown volcanic metasediment. Could be a tuff. Uncertain as to what type this is. Small outcrop. [illegible] left

Elev

2000' @ 12[15] @ 51°

to it.

W-80-[illegible]

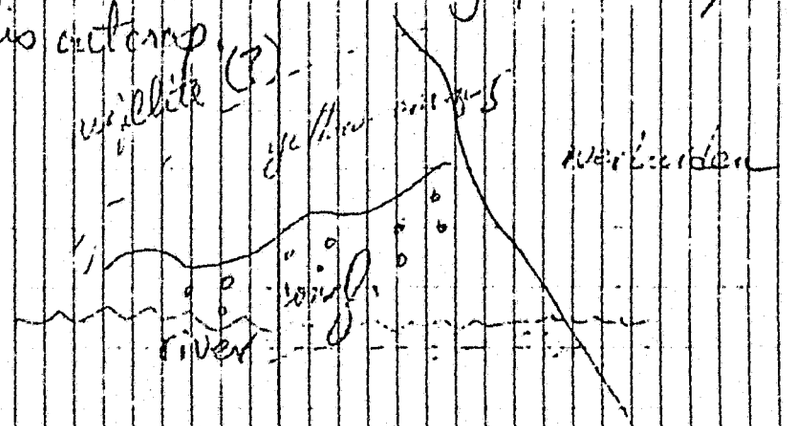
[illegible] weathered volcanic rock. [illegible] Inclusion may be due to [illegible] the [illegible] silica.

Elev 2007' @ 12[40] @ 50°

Sample taken. Is it a tuff

W-80-221

Highly oxidized and weathered outcrop on the right abutment. Outcrop is composed of a gravelly conglomerate, a clean fine grained sandstone and a dark gray argillite. The conglomerate has a dark gray matrix and the gravel appears to be all dark gray, phaley, argillitic material. The clean sandstone is white gray in color. The outcrop is exposed at river level and is approx. 200' high and at least 300' long. The yellow-orange weathered zone is mostly the fine grained ~~sandstone~~ felsic dike? Accessibility problems w/ this outcrop.



W-80-222

Outcrop of volcanic sediments on left abutment of the tributary which flows into Fog Creek. Weathers to a red or black color. Very fine grained volcanic sediment

Bedding

68° 11° SE

46° — 84° —

Joint

16° 84° SE

130° 73° SW

Dark gray fine grained rock [illegible]? It's red in some places. Have some calcite or carbonate fillings. Tuffaceous [illegible] deposited subsequently. Sampled

W-80-223

Large outcrop on the right abutment. Seems to be a mixture of argillite and volcanic metasediments. Is this a variation within the Lag unit? The outcrop is highly oxidized and slightly weathered. Fairly competent rock. Have the dark gray argillitic rock (w/ [illegible] inclusions of hornblende xtals Dan). This has some thin green fine grained layers within and thicker layers at the bottom of the outcrop.

Flew back to camp.
Watana
2249' @ 3.55 @ 48°

Began to get really miserable out and I began to feel sick, call it a day for in the field.

8-25-80
[#2, 68]

It's another beautiful morning, some clouds. Today we are switching back to Watana. Hope to define the Diorite / Argillite contact on the Susitna just upstream from Deadman Creek. After that, Dan and I will work along Tsusena Creek.

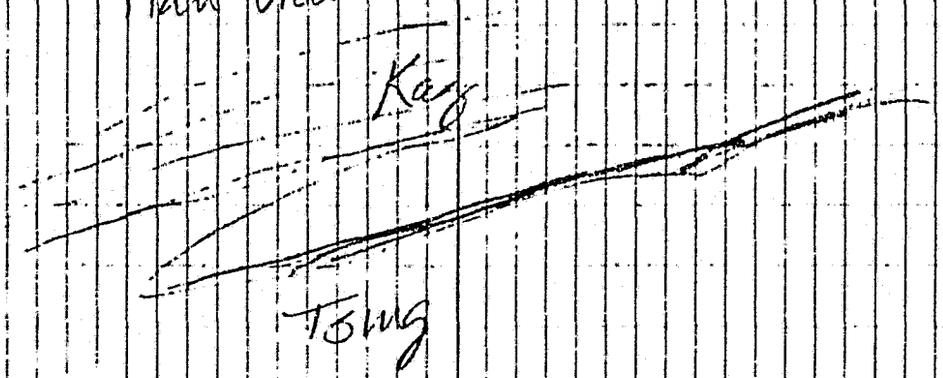
Watana 2262' @ 7:00 @ 48°

W-80-199 (cont)

Contact of the diorite, Tsmg with the argillite (Kag). Some tegmatic folding. Along the contact area, there is a wally more of a quartz concentration in the diorite. It's a sharp contact. Xenoliths of diorite w/c the Kag. Tsmg is a diorite or quartz diorite. Think

there may be some quartz in the Tsmg. The biotite diorite has biotite alligned due to flow. Kag is dark gray, has some biotite, going towards a schist, and it is denser here. It weathers to a dull dark gray which has oxidized somewhat. The Tsmg is a white biotite diorite or biotite quartz diorite. The Kag has been highly fractured and probably sheared at the contact (w/c a foot) in some places.

Plan view



Wavy irregular contact

Contact S&D where exposed

80° 62° N
81° 79° N

Fire [illegible]s 16-25

Tsmg may be just along the bedding plane, sills, thus we are just close to the contact

Elev. 1515' @ 9[illegible] @ 50°

Outcrop is ~16 paces long and up to 20' high

Joints:

	355°	55° E
	320°	70° SW
	293°	68° S-SW
* ~5'	315°	28° SW
	292°	69° S-SW
	40°	60° NW

Bedding

	69	73° NW

Joints

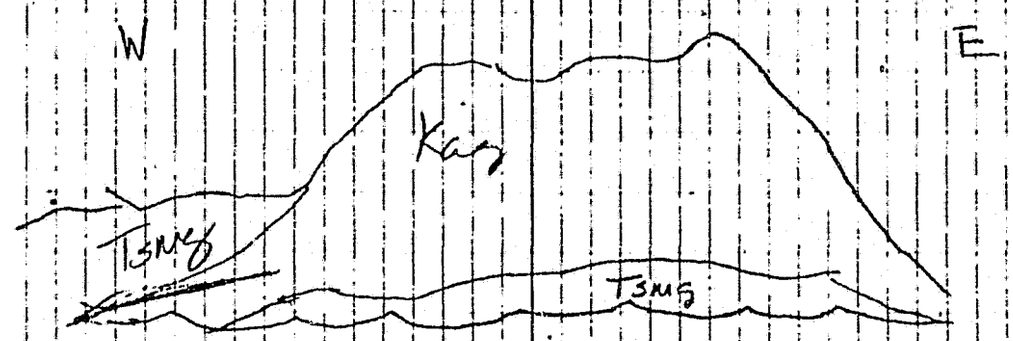
	16°	39° E	
	321°	62° NE	
*	78°	24° S-SE	4" - 2.5'
	312°	79° SE	

Rear 77° 73° N-NW

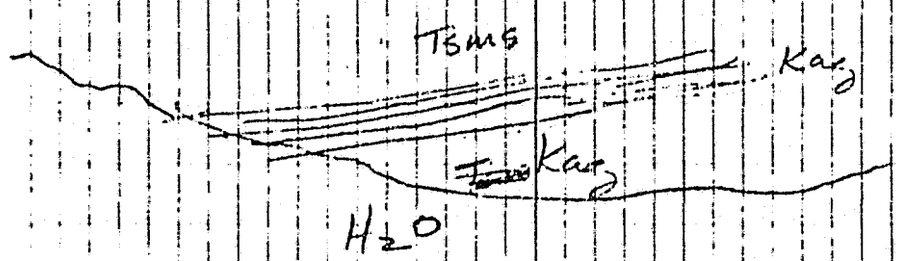
hammer length wide

Possible shear zones are parallel to bedding. All joints are mostly irregular, slightly rough

292° - 68° S-SW is plane & smooth



Plan

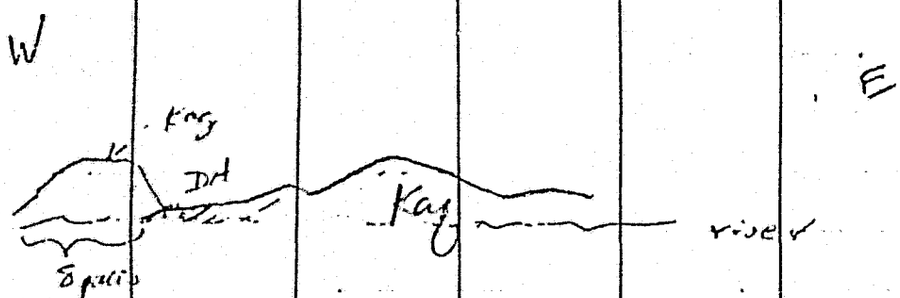


W-80-233

Long outcrop, along the River up to 10' high but mostly ~ 3'. It is ~~85~~ 85 paces long, feet. Outcrop is mostly Kag. Thinly bedded argillite and graywacke (?) intruded by a couple of dikes. Argillite is a reddish dark gray. Beds may be overturned here. Sampled.

bedding @ 51° 81° SE
ⓑ 40° 85° SE

Kag is very platy & thinly bedded. Some places are highly jointed and others are not.



Dike @ 33 paces, aphanitic texture. Lt gray color which has been oxidized. Strike ~ 93°, 3' wide. Samples taken for desc. later. Kag - slightly phyllitic, dark gray, w/ biotite sheen interlayered w/ a light green, quartz w/ concoidal fracturing. Dikes of dioritic material, some is medium grained and the lt gray color is a quickly cooled mostly aphanitic material.

At 52 paces, Kag w/ geoliths of Dorit
68° - 70° NW

W-80-234

Blocky small outcrop w/ blocky talus. It is a biotite quartz diorite which is [illegible] somewhat. Medium grained rock. CI ≈ 30%

2055' @ 10^{29} @ 57°

W-80-235

Small outcrop of the dark gray argillite, Kag. Outcrop is ~40' long & 10' high. Not much of shaley weathering

Elev. 2002' @ 10^{41} @ 57°

* Bedding - think it is

57° 76° NW

Joints:

290 84° S

55° 73° NW

373° 63° NE

* 320° 57° SW 3'-1½'

Watana 2298' @ 12^{35} @ 61°

reset 2262'

Going to Tsusena Creek

W-80-236

A greenish, white-gray, medium grained granodiorite. Contains quartz biotite, hornblende and plagioclase. CI ≈ 10%. The granodiorite weathers to white-gray color which is covered by Fe staining (mostly). There is also an aphanitic zone (dike?) which has intruded the granodiorite. This is probably from the same source except its more siliceous and it occurred later. It has a white color but it is entirely covered w/ Fe staining. See photos 26, 27. The outcrop has also been sheared

Shears

18°	85° W
78°	58° N-NW w/ rots of clay gouge
82° or	44° N-NW
20°	82° W - badly decomposed zone ≈ 1'

Joints

74°	59° S-SE
16°	78° W
62°	60° SE
3°	38° E
319°	89° S

Granodiorite has been sheared badly. Very rotten in places, clay gouge, sulfur staining, plagioclase has been highly altered — bleach white - see sample, - this alteration gives us the white clay gouge. The shear zone w/ the clay gouge is ~ 12' thick

99° 68° N

Outcrop is badly decomposed in places

Joints

289°	75° N
293°	40° NE

Slickenside surface (?) - yes - very faint

99° 72° N

dip 15° W

this is nested badly decomposed zone. zone ~ 2'-3' wide

Joints

321°	85° SW
55°	88° NW
285°	46° N
17°	88° W

Shear

~342° ~ vert badly decomposed, some clay gouge ~ 3' wide

Base of cliff

1687' @ 2^{25} @ 66°

Mylonite zone - no slickes
357° 78° E
350° 74° E } ~ 4-5' wide zone

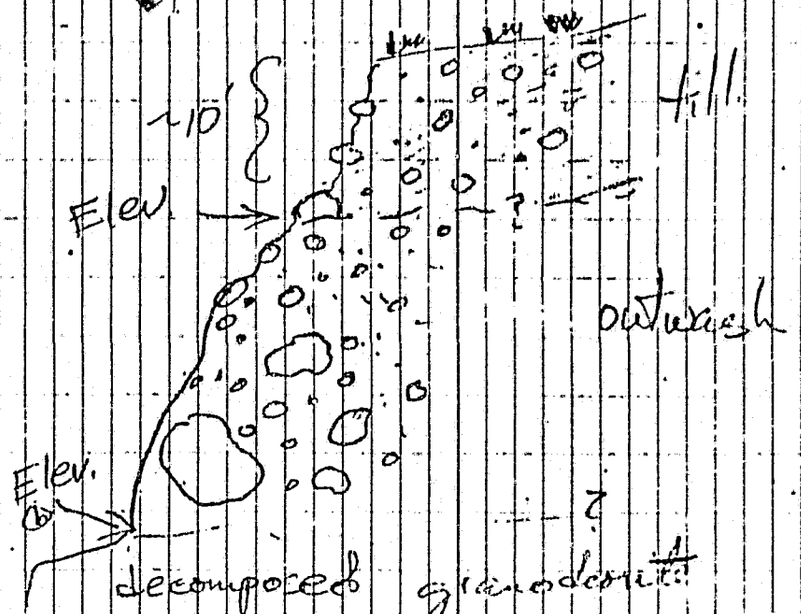
W-80-238

Very bouldery & cobbly sand non-stratified deposit. Little to no silt, w/ boulders up to 6'-8'. It has a buff to tan med grained sand matrix with many pebbles < 1"-2"

Elev 1988' @ 3^20 @ 60°

This is capped by a gray, very hard clay sandy silt or clayey-silty sand. It is gray when dry and a medium brown when wet. Contains boulders up to 3' thick. I can see some striations but is sure. In any case the pebbles to cobbles - many are polished, subrounded it's a till ~10' thick

Many pebbles and cobbles in the sandy material are oxidized



Complete deposit is nonstratified

OW - 1966'
? - 1974'
Till @ ~ 1985' top

(b) 1929' @ 3^53 @ 60°

After taking the sample it appears that the till is only a few feet thick. The rest is silt which has washed down on top of the outwash in sig face

W-80-239

Large outcrop of the dioritic complex. Here the rock is more siliceous ~25% quartz, has a low CI, ~5-8%, and some of the biotite has been

Elev. 2105' @ 4^{37} @ 63°

altered to chlorite. Contains quartz, biotite, plagioclase and some chlorite. It's a whitish gray rock and it is medium grained. Weathers to a yellowish-white color; Has a slight oxidation in some places

Joints:

	22°	86° W
	303°	44° NE
	26°	82° W
4"-1.5'	6°	44° W
	302°	44° NE
	84°	74° NW

The rock is more like a granite here.

W-80-240

Green but mostly dark gray porphyritic basalt. The groundmass is aphanitic and phenocrysts are mostly 1mm but up to 2 mm. Phenocrysts of plagioclase and possibly augite or amphibole - needle xtals. It's a very massive outcrop. Outcrop is on Tsusena Creek on the right abutement. ~20' high and ~50' across

W-80-241

Top of cliff above the Falls. Have a hornblende, biotite granodiorite. Mostly medium grained, light gray. Contains quartz, plagioclase, biotite, hornblende with large occasional xtals of albite, has good cleavage no striations. Oxidized to a faint orange color - Fe staining

Joints:

282°	78° S
8°	72° W
313°	77° NE
46°	82° NW
294°	85° S-SW

Watana.
2295' @ 5 47 @ 54°

Nearly completed all of Tsusena Creek

8-27-80

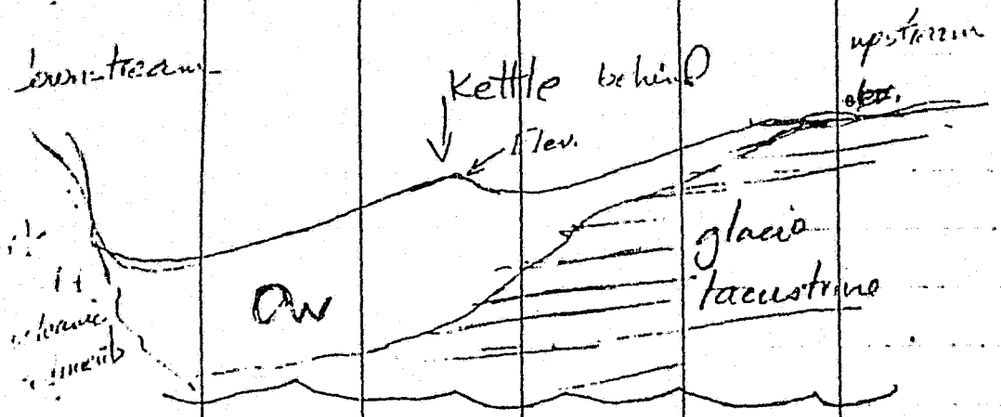
It's another nice day, with a thin cloud cover. Will work between Tsusena and Deadman Creeks on the right abutment, looking for or defining the borrow material here. Dan's at Devil Canyon

Watana
2262' @ 8 42 @ 46°

W-80-242

Buried channel between the Susitna River and Tsusena Creek. Appears to be a deposit of glacio-lacustrine stratified fine sand w/ small silty sand and sandy silt layers. Has good fine x-beds. This is covered on top by an outwash composed of a medium sand w/ 20-30% coarse cobbles. Sampled the glacio lacustrine.

Bedding
293° 8° SW



Elev. 1548' @ 9^30' @ 49°

W-30-243

On Tsusena Creek, exposure of sand and gravel on left abutement. Walked down the slope and then will walk up

At elev. 1954' @ 10^02 @ 52°
Exposure of outwash, medium grained sand matrix with rounded cobbles and boulders

Co. material is Fe stained slightly

Ow exposed down to 1902'
@ 10^11 @ 52° Biggest boulders up to 2.5'-3.0'. Primarily in the 6"-8" intermediate diameter range.

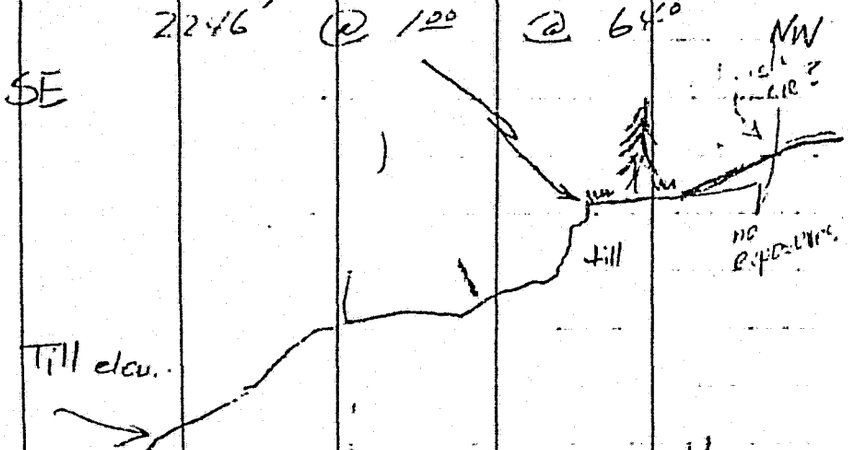
Ow exposed w/ a thin clayey silt
1989' @ 10^30 @ 53°
layer of <1' thick.

Ow exposed all the way up to the top of the cliff. The matrix
2161' @ 10^41 @ 53°
is of a fine grained sand rather than medium.

Watana
2308' @ 12^23 @ 60°
Reset

W-80-244
Mudflow ~ 180 across in the scar and ~ 16' high. Boulders and cobbles are striated a great deal.

Elev. @ top
2246' @ 1.00 @ 64°



Till, lodgement is a gray silty sand with pebbles and cobbles. Some boulders up to 1' in diameter. Clasts are striated. Till is plastic and cohesive. Heat clasts from 1" - 3" inter. diam.
Elev. 2108' @ 1.25 @ 58°
Till still at this elevation, it may have more sand than silt. Very good source at the top — core material

W-80-245
Helo reconnaissance, deposit looks stratified. Possible glacio-lacustrine

W-80-246
On right abutement, on Deadman Creek. Till at the top, cemented somewhat, ~ 8' thick, matrix of sandy silt. Outwash below, matrix of fine grained sand, tan with well rounded cobbles and boulders, boulders up to 3' in diam ~ 30%. Till has cobbles

up to 4' in diameter, mostly

Elev. 2318' @ 2.36 @ 56°
- till/ow contact
2330' @ 2.37 @ 56°
- top of till or bluff

Watana
2295' @ 4.20 @ 56°

After flying upstream on Deadman, it looked as if there was some outwash. Tom and I then proceeded to fly across the hummocky area where the lakes are to look for any possible till. Even though we could only see the surface material, it was sandy material. Will write an evaluation on Borrow site "D"

8-29-80
[#2,77]

It's still cloudy out today and its trying to rain again. Worked this morning on Portage Creek and this afternoon we will work on Fog Creek. Dan and I want to define the Kag / Drt contact.

W-80-247

Mud slump in till. Non-stratified deposit with a gray-brown or yellow brown (tan) is its wet, sandy clayey silt, slight plasticity with pebbles to cobbles. Clasts are striated, generally elongate and have rounded edges. Pebbles to cobbles ~15% (>1"). Mudslump scar is ~70' long, up to 40' wide and ~17' high. Mudslump is on a 12° slope to the north (355°)

W-80-246

Exposure of non-stratified material. A brown sandy silty sand to sand silt. Clasts are striated, mostly elongate, rounded edges. Matrix is slightly plastic. It's a till. top of plane is ~ 2320' helicopter elevation

W-80-247

Fairly large outcrop ~10' high [illegible] 120' long. Talus at the bottom, ~10' high. The rock is the dark gray w/ red and green tinge of the argillite. Lots of sulfides, small xtals. Kag is fine grained. Outcrop weathers to a green-red gray to buff gray. Outcrop is oxidized, has sulfur staining and a white stain and it is precipitating. Outcrop is highly jointed.

Joints:

13°	81° W
322°	81° NE
273°	82° S
302°	3° NE
300°	62° NE
0°	83° W ½" - 8"
345°	7° E-NE

Horiz spacing 1" - 3"

Used photo Alt Acc. Cor 4-5-32

9-3-80

It's a mostly sunny, clear day. It is cold and windy. The mountain peaks all have snow on them, [illegible] Tensena Butte. [illegible] work south of Watana Camp today, along Fog Creek.

[illegible] @ 1[07] @ 35°

W-80-250 photo: 4-5-32

Dark gray fine grained argillite, Kw. Massive outcrop. Heavily lichen covered, some Fe and Sulfur staining. Outcrop is like W80-249.

W-80-251

Unconsolidated, non-stratified deposit of a pebbly to cobbly silty-sandy material. The matrix seems to be a silty-sand but it could be a sandy silt. It has a slight to medium brown color. Very slight plasticity in places, semi compact. Clasts are striated, contains 15% - 20% pebbles to cobbles. Has clasts up to ~ 18"-20" in length, most are less than 6". Top of flat crest to creek level is ~ 14'-15'. Clasts have rounded edges. Is a till. Took a sample ~ 3' from surface.

Elev. 2376' @ 2[38] @

W-80-247

Till sampled ~ 10' down at head of mudslump (a) and ~ 7' down on east side (b)

W 80-252

A massive outcrop along the creek on the biotite diorite. Mostly composed of plagioclase and biotite at a quick glance, didn't see any quartz. Now can see some quartz. CI ~ 75%, medium grained. Has a dark (black, because of biotite rich) white-gray color. This narrows down the contact area. Outcrop is ~ 15' high and off a Con here around the bend. Outcrop is massive and blocky, heavily lichen covered.

Elev.
2119' @ 3[17] @ ~40° 36°

W-80-253

A massive outcrop ~ 10' high and 60' long. It has an oxidized weathered surface with some sulfur staining

Color: orange-brown, tan, pale yellow. Outcrop of the dark gray, fine grained argillite. Very hard here, maybe slightly metamorphosed, contact meta.

Elev. 2208' @ 3[36] @ 36°

Joints:

72°	52°	S-SE
317°	62°	SW
357°	24°	E - 3" to
304°	71°	NE

major joints

W-80-254

Black-white, salt & pepper, w/ mm grain size, medium grained rock. Lots of biotite, some plagioclase. Finer grained biotite diorite here, close to contact zone may be the reason why. Small outcrop 15' across and 8' high.

Elev.
2179' @ 3[55] @ 37°

W 255 photo 4-6-30

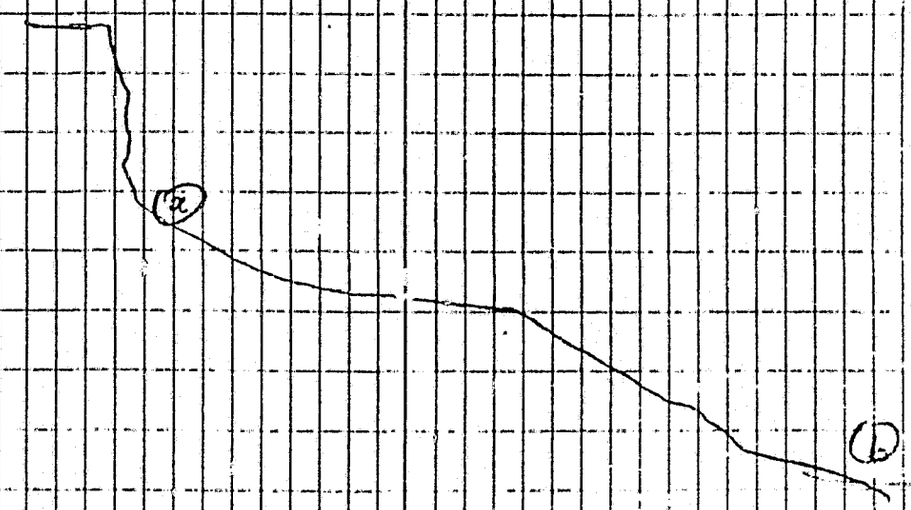
Sampled the volcanic rock. Can't get a strike and dip on this horizontally bedded Tv. It's heavily weathered in places. Outcrop is on the south tributary of the creek. It's at least 30' high and 100' across. Mainly a dark gray, fine grained ground mass w/ calcite or quartz fillings. In some places the rock is highly weathered, vesicules would this be ash

W-80-256 photo 4-5-28

Several very large mud slumps, vertical wall at head ~ 18'-20' high ~ 70' across. The one faces north at its head. Clasts are striated (heavily) and subrounded mostly. Clasts are generally < 8" across and make up ~ 20%.

Matrix is moist, breaks in chunks, has silt, slight plasticity - a clayey sandy silt? Hard to tell hands are very cold. What ever, its a till

Elev. @ 2026' @ 4[56] @ ~35°



Till is med brown w/ some med. gray. Clasts mostly elongate

(b) 1941' @ 5[04]

Photo #8, #9

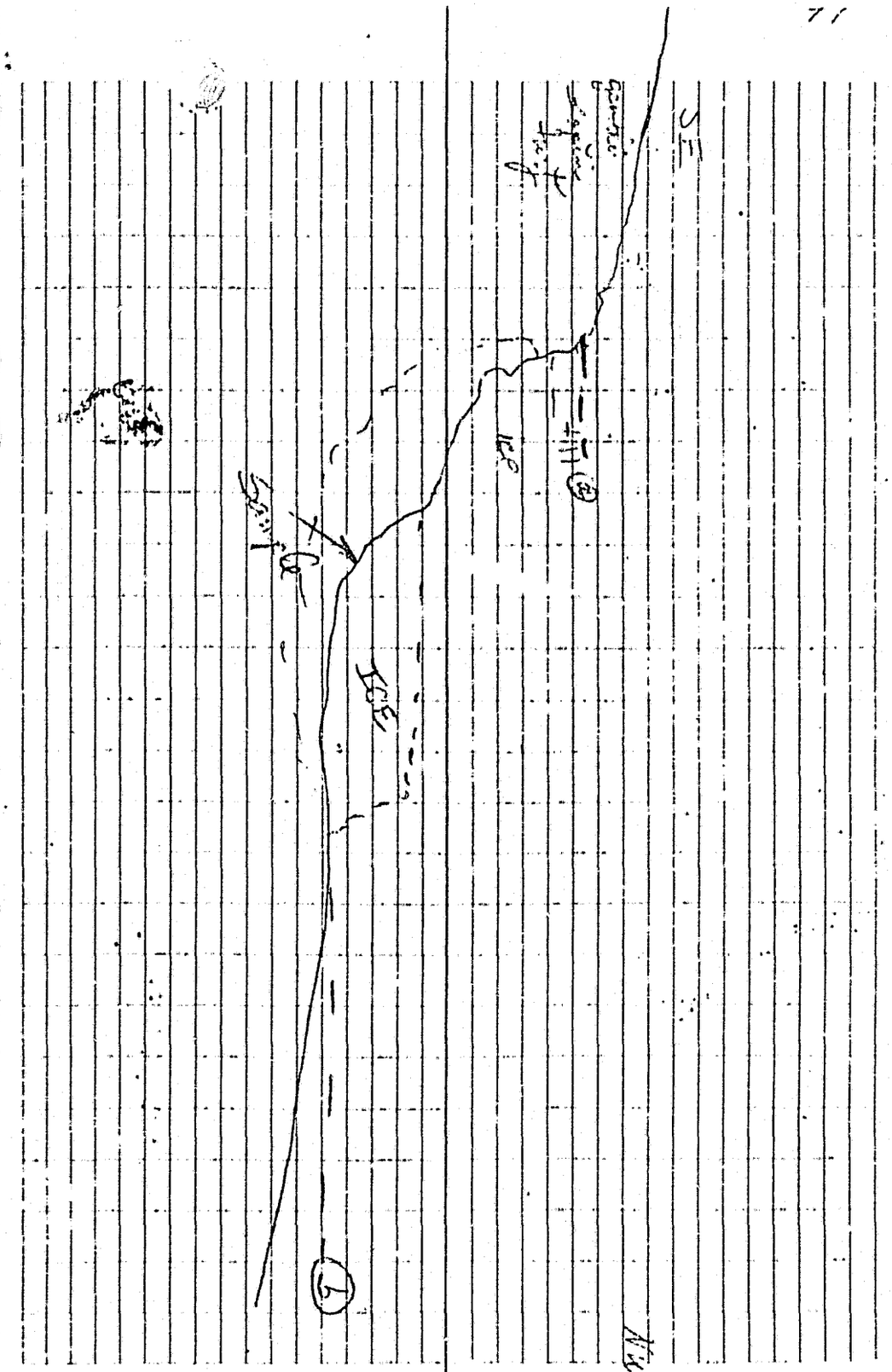
W-30-257

Large mud slump just above the Susitna River. Orientation of slump is NW. Large ice dense is exposed at the head minimum 15' thick

Elev. 1860' @ 5^{34} @ 36°?

Scarp at top is a 100'-130' across several hundred feet long. Ice is relatively bubble free w/ small spherical bubbles, small inclusions of all ~1"

Till has a sandy silty clay matrix which is moist to wet, soft where sampled, probably due to the huge ice dense. It has a medium brown color (to medium gray). Clasts are striated, mostly subrounded and elongate. Generally less than 8", ~ 20% boulders, cobbles, and pebbles. Sample taken. Till seems to be moderately plastic and at



least 20' thick. Tills soft
[illegible] push index finger in easily,
four fingers indent slightly

(b) Elev. 1796' @ 5.45 @ [illegible]

Watina
[illegible] @ 6.08 @ 33°

9-4-80

It's a clear, cool, sunny day,
the overnight low was 16°. Well
work a few hours south of Tag
Creek, where we went with N.
Ten Brink

2262' @ 8.32 @ 36°

W-80-258

A long ridge fed by tiles
slopes on a high ridge. Could
have initially been a lateral
moraine on the valley wall that is
being reactivated by tg, will
begin forming lobes of rock glacier

Elev. 4646' @ 9.20 @ 36°
Upper surface is of blocky material

This ridge [illegible]
knots on the valley here. Ridge
may be just coalescing tg.

Rock [illegible] the green [illegible], med grained [illegible], possibly a sandstone or graywacke, inclusions of pyrite [illegible]

Photos 18, 19, 20 rg, landslide

W 80-259

Top ridge of broad, gently sloping lateral moraine ridge. Slopes ~ 2°-5° & couple of hundred feet wide ~ 300'. Sandy matrix pebbles mostly ~ 1½"

Elev.

3657' @ 9.52 @ 38°

(3°)

W-80-260

Lower most moraine ~ 100' across. Sandy pebbly matrix some boulders

Elev. 3461' @ 10.03

(3°)

W-80-261

Lateral moraine ridge on opp side of valley, top one. Approx 70' wide, not as broad, material not exposed on crest as it was.

Elev. 3545' @ 10.07

on the other side Slope (1.25° ?)

Photo of kame delta

Over to kame delta

W-80-262

On the very flat top of a kame delta. Contains probably the pebbly sandy material

at snout — Elev 3217' @ 10.18 @

Two levels of the kame delta & thus the proglacial lake.

Top dips gently towards the snout

Lower level 3074'

at head, base of higher one

W-80-263

Same lateral moraine ridge on the W-SW side, further down valley. ~70' wide. See 261

elev. 2413' @ 10^{42}

Watana

2278' @ 11^{01} @ 42°

Lower delta is cored by bedrk. Looks like outwash, very flat top

Photo of Debra & Hayes

9-6-80

It's another beautiful, clear, sunny day. I'm going to work north and northwest of Borrow site "E" while Dan begins working on the bedrock geology between Devil Canyon and Watana.

Watana

2262' @ 7^{25} @ 40°

Photo: 4-3-29

W-80-264

A slightly stratified sand and gravel exposure. This is beneath a fairly flat area with relatively no bedrock exposed upstream from here, at least for a short distance. Appears that this might be a buried channel.

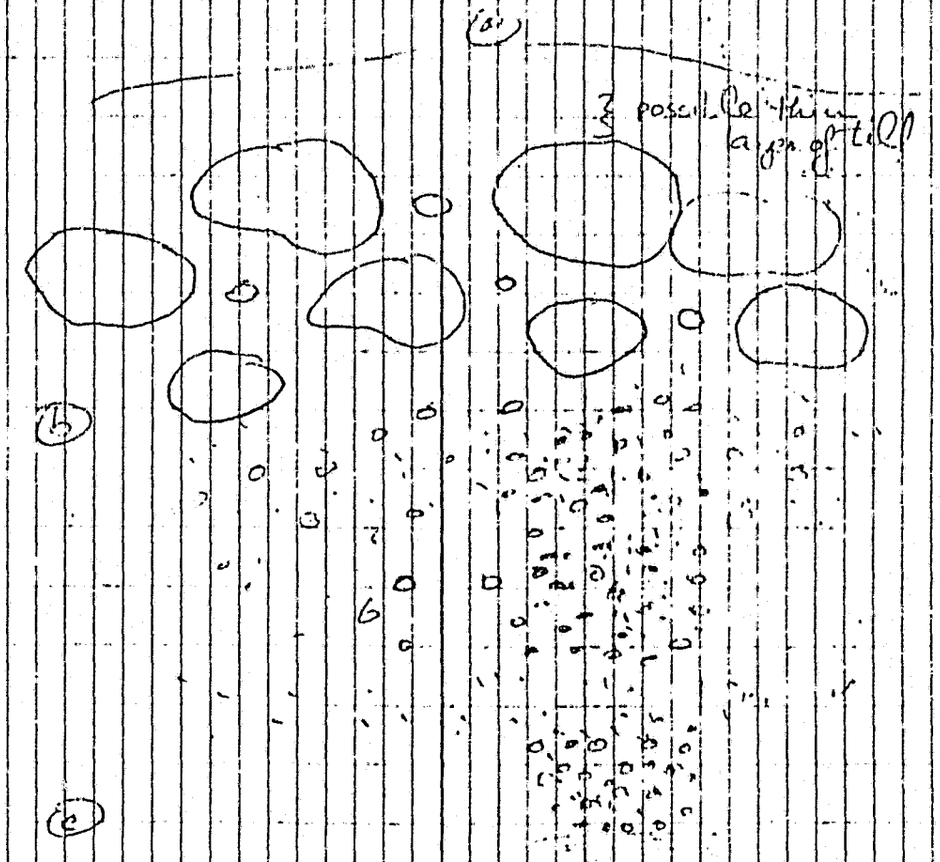
Elev.

2412' @ 8^{31} @

running through here. This is a good x-sect through the stratified drift. Upper part was deposited by a high energy source with subrounded to [illegible] up to 5 [illegible]. This is about 8'-10' thick. This has a [illegible]. Under [illegible] this is a [illegible] of cobbles in a [illegible] medium grained sand matrix. Clasts are rounded to well rounded and generally less than 5 in length.

Elev. @ 2399' @ 8.45 @ 4[illegible]

The small cobbly [illegible] are [illegible] cemented, the clasts which are [illegible] nearly horizontal. Might even be able to get a good fabric here. The [illegible] comes from layers of fine to med. [illegible] sand, [illegible] sample, with [illegible] pebbles & cobbles, usually



less than a couple of feet thick

(c) 2312' @ 9.00 @ 47°

Sample (a) cobbly sand
(b) med. sand [illegible]
Just matrix of (a) had to dump out

(c) Sample of a [illegible] clay

Layer of a [illegible] (light) sandy silty clay. Can insert index finger, moist, moderate plasticity, [illegible] well sample # (c)

This grades [illegible] cobbly [illegible] silt and the [illegible] [illegible] cobbly, pebbly med gr sand. [illegible] this at

2275' @ 9.5

and 8' above there is a cough zone, see [illegible] samples. [illegible] this is the hard [illegible] med gr sand zone and then the cobbly sand again.

Bottom [illegible] is [illegible]

2200'

10-80: 265

At 2398' @ 9.55 top of exposure has a thin cover of blue-gray and light brown clay w/ mod to high plasticity. Beneath this is ~ a 10-15' zone of boulders in a cobbly pebbly med gr sand. Cobbly pebbly med gr sand zone continues down to Elev.

2486' @ 9.49 @ 54°

top of flat plane and is interrupted by the med gr sand zone, poorly sorted* ~ 6' thick.

The partly lithified Ow cong zone is only a couple of feet thick @ 2465' @ 10.05

At 2312' @ 10.0 Down to here it is the cobbly, mostly pebbly medium grained sand, yellowish brown. Below this level, [illegible] is pouring out of this zone.

Seepage along a [illegible] channel [illegible] beneath the [illegible] at which water [illegible] out [illegible] - thinly [illegible] the clayey zones up to at least 6' thick are very hard, blue-gray to [illegible] gray to red-brown [illegible] alternating with [illegible] bedded zones of a yellow black possibly [illegible] sandy clayey silt [illegible] fine grained, also very hard.

Beneath each clay layer [illegible] to co. sand in a med. gr. sand matrix.

Clay is plastic, breaks into thin wafers.

The clay zones extend down to 22 60' beneath which there [illegible] layers of med. grained sand with some clay-silt stringers in between [illegible] more or as thinly [illegible]

Med sand is white-gray and a yellow-orange brown

On the last two exposures there is a possibility of a thin veneer of till 2' on 264 and est > that on 265, a dark brown sandy silt matrix, breaks into small clumps

Watana

2233' @ 11^04 @ 52°

reset

Returned to Watana, engine chips in the oil on Willi's ship.

W-80-266

Elev. of top of flat plain

2602' @ 11^55 @ 60°

Its a med to dark brown sandy silt or silty sand (when wet). It has few clasts but the one's that can be found at the base of the slope are subrounded, slightly elongate to elongate, most edges

are rounded and the clasts are striated. This is a sandy, ~~loss~~ Till?

Elev. at top of exposure
2544' @ 12^{07} @ 60°
≥ 25' thick

[illegible]

Outcrop of [illegible] [illegible] weathered outcrop of the [illegible] co. grained biotite granodiorite C.I. ≈ 15-20%. [illegible] with some biotite and quartz. Outcrop [illegible]

[illegible]
2356' @ 12^{26} @ 50°
2413' @ 12^{27}

Outcrop across the way is [illegible]

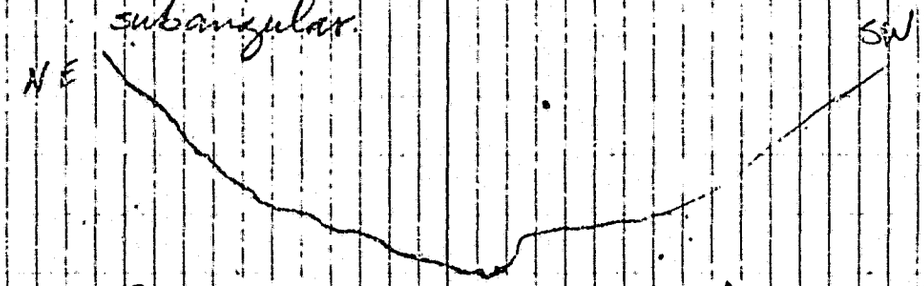
[illegible] 2256' @ 12^{49} @ 50°

9-8-80

It's a nice sunny day. Will work north of Watana Camp (T.D.)
Watana 2262' @ 12^{46} @ 54°

W-80-268 — topo sheet

Up Clark Creek. On flat surface, 2850' on the right abutement of Clark Creek. Material is a medium grained sand w/ pebbles to cobbles - mostly subangular.



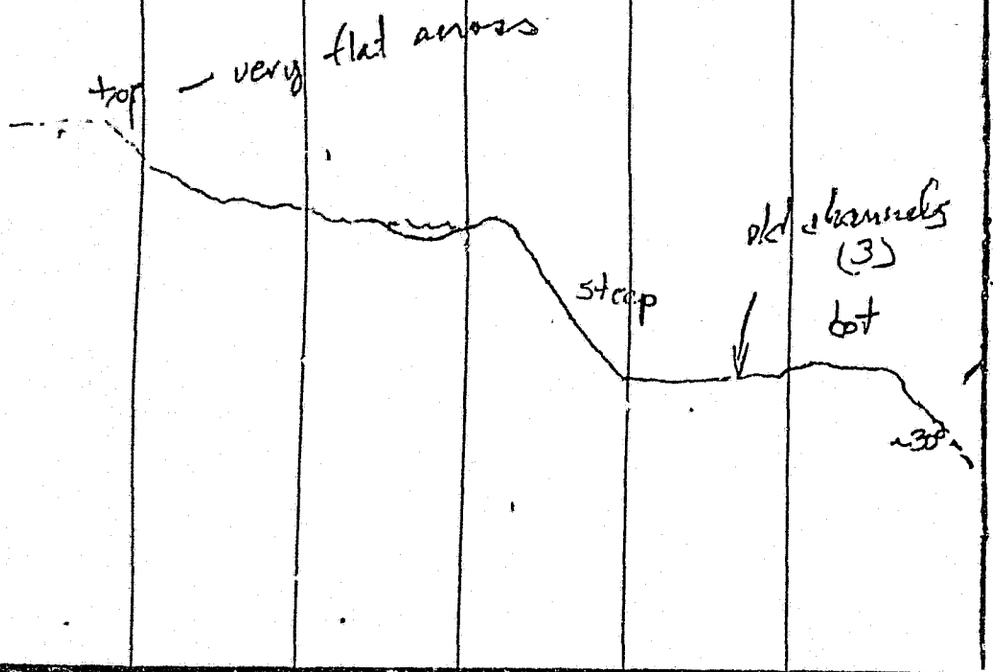
Ow which has been re-cut giving terrace look or kame terrace?

IW-80-268

Lateral moraine ridges
Upper west fork of Deadman
On the east side of valley

						Helo
top	3967'	@	2^{16}	@	52°	4000'
mid.	3881'	@	2^{21}	@	52°	3900'
bot	3756'	@	2^{24}	@		3775'

north ridge of pond

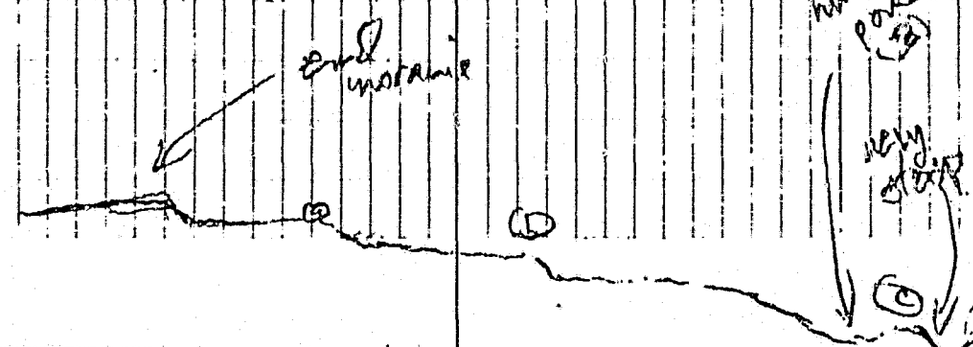


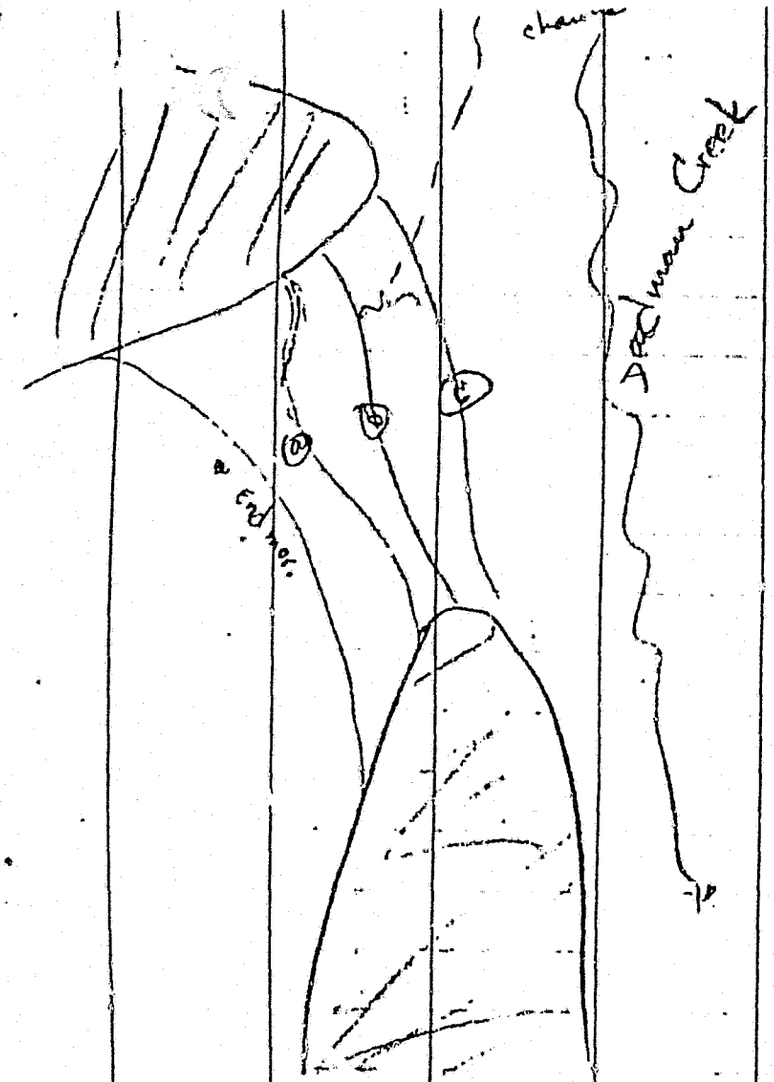
Light brown pebbly to boulder mat'l w/ a fine-med gr. sand matrix
Cobbles & boulders are subangular to subrounded - up to 2.2' in length

IW-80-269

Lateral mor. w/ possibly an end moraine. Three lateral mor. w/ end moraine (?) NE from side valley. Moraines are more subdued here.

					Helo.
End mor.					3980'
Top	ⓐ	3935'	@	2^{37}	3960'
	ⓑ	3871'	@	2^{42}	3885'
	ⓒ	3662'	@	2^{46}	3660'





W-80-270
Exposure of sandy till.
Clasts have striations.

W-80-271

Tan to light brown fine grained sand w/ some med. brown silty sand. Stratified deposit. Have an occasional pebble to large cobble. Well washed poorly graded. Upper surface is flat.

Elev. 2603' @ 4^{42} @ 54°

Possible beach ridge - [illegible] washed [illegible] well sorted, partially oxidized.

On D/W Creek, till exposed in lower reaches at approx 2200'-2100' and below. Above there is outwash

Watana
2284' @ 5^{2} @ 52°

In the morning, I worked in the Devil Canyon area.

W-80-[illegible]

[illegible] slope) [illegible] long [illegible] 60'-70' a[illegible] clasts [illegible] for the [illegible] [illegible]

9-10-80

It was really foggy this morning and its now beginning to lift. Will work above Borrow site "E" and in the SE edge of the Susitna "box".

Watana

2262' @ 8[30] @ 38°

W-80-273

LT to med brown till, with a sandy silt or silty sand matrix it's non-plastic. Clasts up to cobble size - some are striated. Clasts are generally elongate and subrounded to subangular - no sharp edges.

top of

2833' @ 9[07]

W-80-274

A slump scar on the right abutement of "E" Creek. This is pebble to cobble size material in a (moist) med brown clayey sandy silt matrix - slight plasticity. Clasts are generally < 10" in length with only a few larger clasts. Some clasts are striated. Clasts are generally elongate and have rounded edges, subrounded. This is just a loose sandy till. The sandy tills may be melt-out tills. This is probably what was seen at the last site. Sampled

Elev 2581' @ 9^{25} @ 49°
elev. of slump

Elev top of flat ridge
268' @ 9^{32}

W-80-275

Intense physical weathering of the biotite granodiorite. CI = 10 to Lots of white plagioclase, some biotite and quartz. Med grained. Outcrop of the rock and a sandy to granular material exposed on the outer slopes of the dissected gently sloping flat plain. Check other exposures for verification.

Elev. of plain here
2991' @ 10^{01} @ 49°

W-80-276

Amphitheatre slump which faces SE on a 10°-15° slope. It's an old one as vegetation has taken hold in the scar. Exposed is a med gray brown (moist) silty sand or possibly a sandy silt matrix w/ mostly pebbles and cobbles. Boulders up to 3' in length. This is the loose sandy

till. It has mostly elongate clasts that are subrounded. Only a few clasts have striations.

Elev of top of slump
2424' @ 10^{34} @ 52°

W 80-277

Slump exposure of till w/ a slight to moderate plasticity. Exposures face (310°) NW. Clasts are heavily striated. Most clasts less than 1" in length but some are larger. Matrix is a sandy clayey silt. Fairly soft. Slump on a 5°-10° slope

Elev.
2262' @ 2^{15} @ 57°

[illegible]

(moist) [illegible] some [illegible] color.

[illegible] top of dissected slope
2164' @ 3^{32} @ [illegible]

It contains clasts up to 3' in length. There seems to be a zone of sandy silt ~ 15' down from the top of the exposure. Haven't seen any striations. See DH-30

Soft, moist, like the brown sandy till.

W-80-279

Slump exposure of crest along Deadman Creek. Upper slump is a light to medium brown silty sand with clasts up to 2½' in length. Mostly a fine sand. Some clasts have striations. Most clasts are rounded to subrounded and slightly elongate to elongate.

Elev 2293' @ 4^{23}

The lower slump, (SE, 158°) is composed of a compact, hard, medium gray (moist; dry = buff gray) lodgement till. Only has slight plasticity. Contains clasts up to 12' in length which are mostly elongate, have rounded edges and are striated.

Elev. - top

2220' @ 4^{08} @ 58°

- at least 40' thick in downslope direction on a > 23° slope
- lower down it is softer and has a moderate to high plasticity

Concl.: old slump exposure of till maybe a melt-out till at top or its been washed somewhat. This site is just south of AH-9 it appears to be in a sandy silt w/clay matrix - till?

W-80-280

Fine sand to sandy silt with slight plasticity matrix. Non-stratified. Contains boulders up to 3' in length. This may be a sandy till.

Other exposure ranges from a fine sand to silt matrix. Contains boulders up to 3' in length. Is it till or outwash - maybe a till that is been washed.

Seems to be mostly all outwash with possibly a thin layer of till or lacustrine sediment near the top and maybe a thick zone ~ 50' down from the top. ≥ 15'

Elev. 2334' @ 5^{14} @ 56°

Watana 2296' @ 5^{32} @ 56°

Dan 1/2 day

9-11-80

It's a clear, beautiful, sunny day. Will check the area of Borrow site "F" and one possible till location on Deadman. Then I'll begin doing the surficial geology in Watana Reservoir Dam & continuing on the geology in the Devil Canyon Reservoir

Watana 2262' @ 8:00 @

W-80-281

Slump exposure of sandy till Matrix of fine sand w/ some silt. Clasts generally elongate and rounded edges, some are striated Sandy till

Elev. 2444' @ 8:36

W-80-282

On Deadman Creek [illegible] abutment. Top of [illegible] boulder in a fine sand [illegible] Boulders up to 3' in length. Ow here

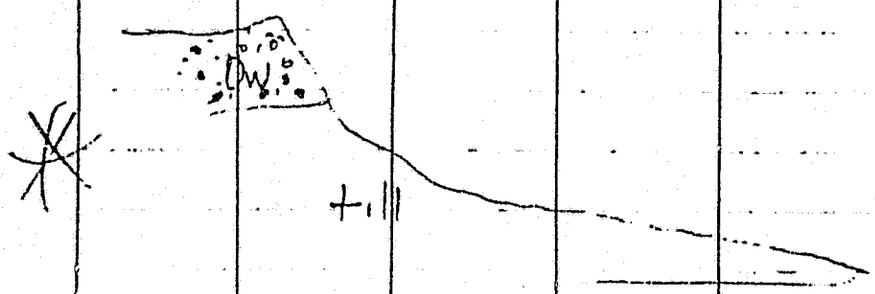
Elev. top 2275' @ 9:10

Going downslope, till is exposed at approx 2250'. It's the sandy till, matrix is a silty sand (brown, moist), clasts are striated.

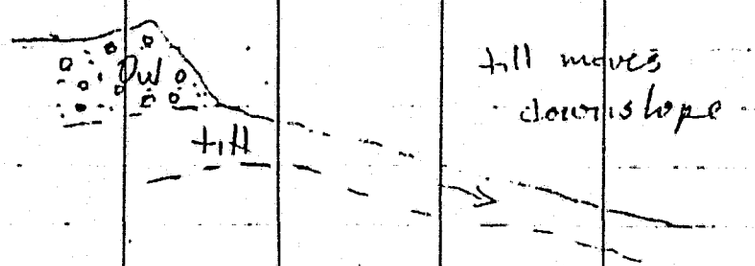
At 2213' @ 9:15, the till is semi hard, a dark brown (moist) sandy clayey silt or sandy, silty clay. Clasts here are heavily striated. Slight to moderate plasticity

At 2089' @ 9:30 @ 41°, have a slump scar, vegetation matrix moving downslope in chunks. Have a

brown or med brown?
or lo.
gray clay, can mold, has a med
erate to high plasticity. Pebbles
and cobbles on top are striated
and generally less than 8" in
length with a few up to 18"
Sampled
Models:



or



From ~ 2215' (nearest I can
tell, till is lodgement
Some sand from above got
in the sample. Clay
seems to be pebble-cobble
mostly free

Till appears to be ~ 7'-8' thick
at bottom exposure

W-80-283

Exposures at cliff (bluff) along
Deadman, right abutment. Have
Outwash at the top ~ ≥ 10' thick
OW is boulders on down w/a
medium grained sand matrix

Elev top
2249' @ 10th @ 51°

At ≈ 2183' @ 10th @ 51°, have
a sandy, mostly dry, lodgement till
Clasts up to 30" in length. Till
is dark brown, ~~and~~ is hard,
compact and contains clasts
mostly ≤ 6" in length. Exposure
is an old slump. Dry breaks
in chunks

Till (sandy) at 2229
silty sand matrix

W-80-284

Low terrace along right abutement of Susitna near D/W creek. Mostly pebbles and cobbles in a med gr sand matrix. Oxidized. Clasts are mostly well rounded. Bluff ~ 20' high. Thought it was stream alluvium, but it has a large kettle, OW

W-80-285 - on D/W creek

Large slump scar, a series of them here on this slope. Top of crest is 2270' @ 11:33 @ 57°. Here at the top, slope exposed for 20', have a loose to semi compact till. Matrix is light to medium brown, ranges in grain size from a moist fine sand to a moist sandy clayey-silt. Clayey silt is slightly plastic, cohesive, silt & semi-compact. Clasts are generally ~6" in length although they reach 24". Some clasts are striated & they are generally elongate & have

rounded edges.

At 2018' @ 11:33. Till matrix has more clay, more cohesive, and has moderate plasticity. Clasts are more striated. Till is of better quality here.

Exposed down to 1975'. Also see a med gray fine sand-silt. Very wet, is this lacustrine.

The vegetation mat is ripping apart everywhere on this amphitheatre shaped slump block. Very wet the further downslope one goes.

300° or W-NW - amphitheatre

W-80-286

Bad slumps here on left abutement of Susitna near reservoir level. Till is exposed which is beginning to freeze already. Slump scar exposes 3' thick layer of till. It's a brown (moist) clayey sandy-silt. Clasts generally elongate, rounded edges, and striated

Elev. top
2164' @ 12th @ 60°

* Good place for slope indication in reservoir even though overburden is probably relatively thin

Watana 2274' @ 12[28] @ 50°
reset, lunch

W-80-287

Large slump area on right about mend of Watana Creek. Exposure at head to ~5' high of a medium brown (moist-wet) or light tan (dry) cobbles & pebbles in a sandy clayey silt matrix, cohesive semi-hard and compact and moderate plasticity. Clasts are up to 12" in length, generally elongate, rounded edges or subrounded and have striations. Slump trend E-SE

Elev at top
2014' @ 2[27] @ 60°

There is vegetation in the slump area mostly spruce, but some

birches.

The till in places is at least 20' thick in the small tributary to Watana Creek. Till is sandy in places

W-80-288

Large bluff exposed for > 200 yds continuously. Flat plain above this exposure. Matrix at top is a fine grained sand w/ a little silt and few pebbles. Baked surface looks like a

Elev. 2280' top @ 2[52] @ 60°
2272' bot @ 3[02]

till. At approx ~~35'-40'~~ 20' down the material is moist, very pebbly and some cobbles and it has a brown sandy-silt or silty sand matrix - semi-compact, non-plastic. This is a lodgement till which is ≈ 40' thick. Clasts are striated.

All spruces on top

W-80-289

Glaciolacustrine mat'l. Stratified fine sands and silt layers. Tan to med. brown depends on grain-size & thus moisture. Poorly sorted

Elev. 2432' @ 3:36 @ 60°

Photos Watana Creek
25-28

Watana
2282' @ 4:15 @ 54°

3 people

9-12-80

It's another clear, beautiful sunny day. Discussions w/ Tom on borrow material. Dan is working east of Devil Creek on the bedrock.

W-80-290

Square pits of saturated till. Light to medium brown, soft, moderate to high plasticity. A silty, sandy till with some clay. Located south of Fog Creek & east of the South Tributary to Fog Creek. Spruce vegetation.

9-17-80

It's a beautiful, clear sunny day. Dan is working just west of Borrow site "E" from the Susitna, north. I started in the Watana Creek area. After lunch went upstream along the Susitna River to just past Vee Canyon, mostly looking at the tributaries on the north side.

Watana 2262' @ 9^{12} @ 43°

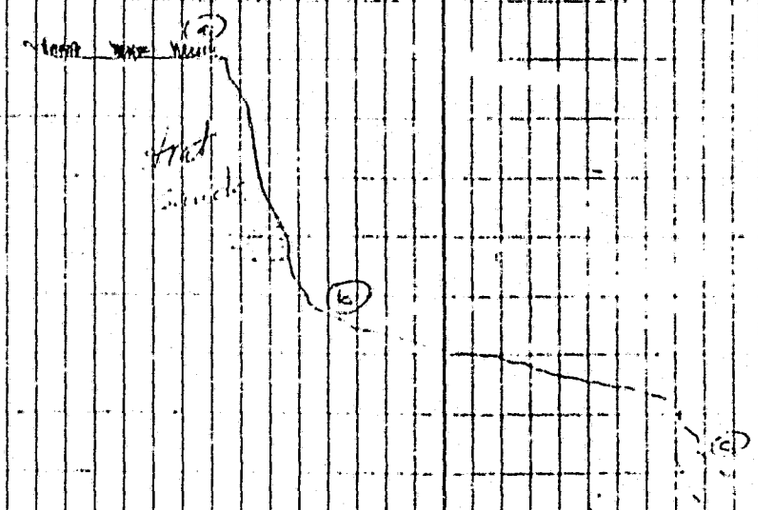
Photos: 2-7-7
2-7-9
2-8-5
2-10-1
2-10-3

Topos: C-1, C-2, D-2, D-3

9/17/80 [illegible]

Top of flat plain, [illegible] downslope to Watana Creek

elev @ 2480' @ 10^{12} @ 51°
(b) 2350' @ 10^{22} @ 51°



(c) tan (dry) to medium brown (moist) silt or fine grained sand. Some cobble pebbles up to 6" in length on the surface of exposure.
2266' @ 10^{32}

Crossed over to the [illegible] lump at approx the same elev. Same thing. Poorly sorted fine grained matl, silt or fine sand. No

exposures further down.

W-80-292

Tan - red brown till. Soft clayey sandy silt matrix. Clasts are striated. Sampled

2262' @ 11^22

W-80-293

Red brown (red) sandy clay/silt till matrix. Soft to moderate travel striations on clasts. Slight plasticity

9-18-80

It is another clear, sunny day. Will take out sites at new proposed Borrow site. Archeologist will check these sites for clearance. Then will take samples.

George Smith U of A - Fairbanks

Watana 2262' @ 9^30 @ 46°

Borrow "H"

80-1

2135' @ 9^30 @ 50°

Swampy area west end of site

Clear

80-2

1905' @ 9^50 @ 50°

relo limited ~ 200 yds away from the site.

Clear

80-3

Swampy area
2109' @ 10^{56} @ 52°
Clear

80-4

Near the slumps on Fog Creek. Can clear ~ 100 yds to the east of.
2108' @ 11^{22} @ 52°
Clear

80-5

pt is not very swampy land approx 250 yds to the SW
2229' @ 1^{53} @ 56°
Cleared

80-6

Slightly swampy, land ~ 200 yds to S SW ... edge of ridge
2282' @ 2^{07} @ 56°
Cleared

80-7

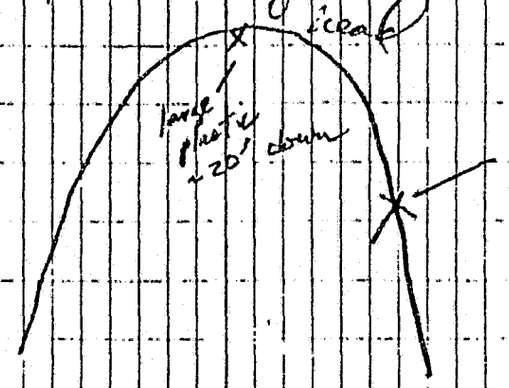
Cleared - Hrch
Large swampy clearing - wide area
2205' @ 12^{39} @ 59°

80-8

Swampy area needs to be cleared
2128' @ 11^{58} @ 59°
Cleared
so that a rig can get in there

W-80-256

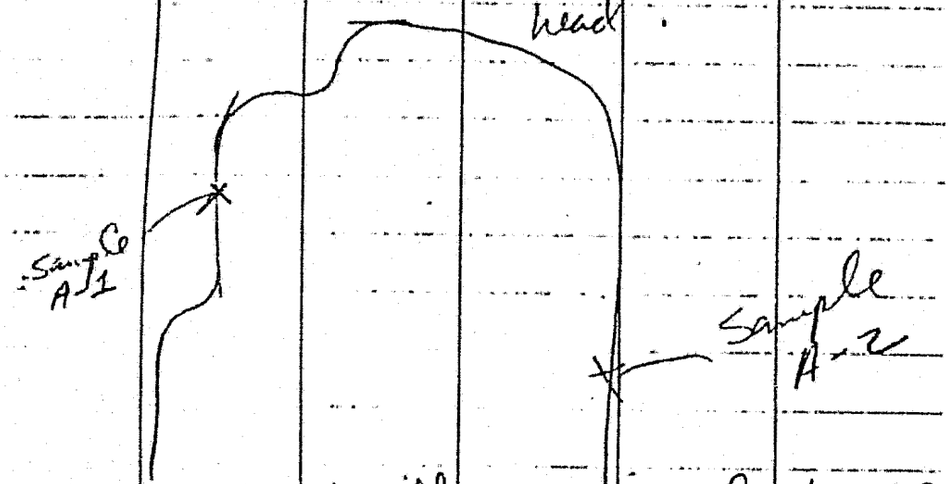
Sampling of lodgement till
Small plastic and large (1 gal) jars plus large sample bag



~8 feet below surface
1 ge bag
1 small plastic

W-80-257

Mud'shrimp w/ large ice lense head.



This till is sandy and saturated, it may not be any good.

A-1 ~5 from vegetation surface mat'l is rather wet.

A-2 ~ 3.5' below surface in brown till

Showed RRH to site and exposure on Borrow site "H"

Watana 2330' @ 5:20 @ 44°

10-1-80

Arrived at Watana @ 10:20. Took pictures at Devil Canyon, south facing wall, overlapping ~#2 through 22, leaves off vegetation, ~ c/L

W-80-294, JOINT SET W-1

*

~~1~~ 7 10°, 84° NE, closed, plane, irregular
~~2~~ 347 350°, 64° E, plane
~~3~~ 117 120°, 65° N, closed, plane, smooth
~~4~~ 22 25°, 18° N, plane, closed smooth
~~5~~ 72 75°, 83° N-NW, closed, irregular, plane
~~6~~ 324 327°, 83° NE, plane, closed, smooth
~~7~~ 67 70°, 85° SE, plane, closed, smooth
~~8~~ 347 350°, 58° NE, " " "
~~9~~ 331 334°, 77° NE, plane, irregular, closed
~~10~~ 319 322°, 12° NE, plane, irregular, "
~~11~~ 287 290°, 67° N, plane, "
~~12~~ 297 300°, 6° NE, plane, " , "
~~13~~ 324 327°, 82° NE, open, plane, irregular
~~14~~ 334 337°, 90°, plane, closed, "
~~15~~ 70 73°, 2° NW, " , " , smooth
~~16~~ 57 60°, 8° SE, " , " , "

*Corrected values marked in red

17.	330° 333°	14° NE	plane	smooth	closed
18.	334 337°	65° NE	"	irregular	"
19.	327 330°	72° NE	"	"	"
20.	330 333°	72° NE	"	"	"
21.	343 346°	82° SW	"	"	"
22.	340 343°	67° NE	"	"	"
23.	57 60°	83° SE	plane	smooth	
24.	77 80°	85° SE	"	"	closed
25.	62 65°	87° SE	"	"	"
26.	70 73°	82° N-NW	"	"	"
27.	345 348°	82° NE	"	"	"
28.	87 90°	63° NW	"	"	"
29.	337 340°	80° SW	plane	smooth	open
30.	67 70°	88° NW	"	"	closed
31.	317 320°	60° SW	"	"	"
32.	342 345°	10° NE	plane	irregular	closed
33.	82 85°	60° N	"	smooth	closed
34.	90 93°	30° N	plane	smooth	"
35.	317 320°	10° NE	"	irregular	closed
36.	62 65°	10° NW	"	"	"
37.	72 75°	16° SE	"	smooth	closed
38.	67 70°	82° NW	"	"	"
39.	94 97°	50° N	"	"	"
40.	332 335°	87° NE	"	"	"
41.	0°	78° E	"	"	"

* Corrected values marked in red.

42.	347 350°	86° E	plane	smooth	closed
43.	297 300°	48° S	"	"	"
44.	302 305°	75° S	"	irregular	open
45.	292 295°	77° N	"	"	closed
46.	47 50°	73° SE	curved	smooth	"
47.	331 334°	56° NE	"	"	"
48.	302 305°	65° S	plane	"	"
49.	42 45°	84° SE	"	"	"
50.	302 305°	65° S	"	"	"
51.	77 80°	48° NW	"	"	"
52.	92 95°	70° NW	"	irregular	"
53.	349 352°	76° NE	"	smooth	"
54.	290 293°	83° S	plane	rough	closed
55.	327 330°	90°	plane	smooth	open
56.	327 330°	83° NE	"	"	closed
57.	322 325°	77° NE	"	rough	"
58.	77 80°	77° N	"	smooth	closed
59.	0°	76° NE	"	smooth	closed
60.	354 357°	2° NE	plane	irregular	"
61.	36 39°	78° NW	"	smooth	closed
62.	20 23°	80° E	"	"	"
63.	297 300	73° NE	"	"	"
64.	18 21°	72° E	"	"	Part open
65.	8 11°	79° E	"	"	closed
66.	330 333°	78° NE	"	"	"

* ~~67~~ 309	312°, 71° SW,	plane,	smooth,	closed
68. 290	293°, 68° NE,	"	"	?
69. 286	289, 20° NE,	"	"	closed
70. 342	345, 86° NE,	"	rough	Part open
71. 77	80°, 20° N,	"	smooth,	?
72. 341	344°, 85° SW,	"	"	Part open
73. 97	100°, 58° N,	"	"	"
74. 94	97°, 60° N,	"	"	open
75. 349	352°, 87° E,	"	rough,	closed
76. 347	350°, 85° W,	"	rough,	part open
77. 319	322, 88° NE,	plane,	irr,	open
78. 316	319°, 88° NE,	"	smooth,	?
79. 77	80°, 21° N,	"	"	closed
80. 56	59°, 82° SE,	"	"	part open
81. 309	312°, 17° NE,	"	"	closed
82. 304	307°, 18° NE,	"	"	"
83. 29	32°, 17° NW,	"	irr	?
84. 337	340°, 89° NE,	"	smooth,	?
85. 7	10°, 80° E,	"	rough,	open
86. 284	287°, 60° N,	"	smooth,	part open
87.				
88.	END.			
89.				
90.				
91.				
92.				

Plotted on red sheet TS. June 30th, 1981

* Corrected readings marked in red.

93°
94 Synopsis: Few large joints
95 at this location. Lots of small
96 fracture faces in the diorite,
97 indicative of igneous rks. Mostly
98 a dioritic type rock with lots of
99 green plagioclase. Weathered
100 surface looks like diorite w/
zenoliths

II	80°, 85 NW	1' to 2.5'	Spacing
	85°, 7° NW	4" to 3.0'	
	25°, 18° W	6" to 4.0'	
III	11°, 79° E	3.0' to 4.0'	
	97°, 60° N	1' to ?	
I	319°, 88° NE	2' to 3'	
	32°, 17° NW	1' to 1.5'	
	307°, 18° NE	1' to 1.5'	

Two photos — outcrop
Two " — boat @ "Fins"

* W-80-295 @ "Fins" right abutement

~~1.~~ 307	310°, 85° NE,	plane,	smooth,	closed
~~2.~~ 308	311°, 84° NE,	"	"	"
~~3.~~ 292	295°, 82° NE,	"	"	"
~~4.~~ 301	310°, 77° NE,	"	"	"

1'-3'

* Corrected readings marked in red.

5.	5	3[illegible] W	plane	smooth	closed	Not plotted
6.	42 45°	48° SE	"	"	"	
7.	47 50°	35° SE	curved	smooth	"	
8.	335 338°	50° SW	plane	"	closed	
9.	310 313°	82° NE	"	"	"	
10.	77 80°	84° N	plane	irregular	cliff face	
11.	10 13°	26° W	plane	smooth	closed	
12.	42 45°	70° NW	plane	smooth	"	
13.	344 347°	26° SW	plane	smooth	"	
14.	326 329°	80° NE	"	"	p. open	
15.	41 44°	67° NW	"	"	closed 3" to 3'	
16.	33 36°	14° NW	"	"	"	
17.	330 333°	87° NE	"	"	"	
18.	60 63°	22° NW	"	"	"	
19.	32 35°	70° NW	"	"	"	
20.	327 330°	85° SW	"	"	"	
21.	312 315°	73° NE	"	"	"	
22.	312 315°	77° NE	"	"	"	
23.	42 45°	52° NW	"	"	"	
24.	324 327°	87° NE	"	"	"	
25.	70 73°	18° NW	"	"	"	
26.	327 330°	60° NE	"	"	"	
27.	42 45°	58° NW	"	"	"	
28.	327 330°	80° SW	"	"	"	1'-2.5'
29.	327 330°	63° NE	"	"	"	
30.	322 325°	80° NE	"	"	"	
31.	32 35°	60° NW	plane	smooth	closed	1'-1.5'
32.	37 40°	65° NW	"	"	"	
33.	44 47°	75° NW	"	"	"	
34.	334 337°	77° SW	"	"	"	
35.	72 75°	85° N	"	"	open	
36.	42 45°	67° NW	"	"	p. "	6"-1.5'
37.	34 37°	58° NW	"	"	p. "	
38.	327 330°	77° NE	"	"	closed	
39.	32 35°	48° NW	"	"	"	
40.	22 25°	62° NW	"	"	"	
41.	42 45°	78° NW	"	"	"	3"-1.5' 2.0'
42.	42 45°	66° NW	"	"	"	
43.	50 53°	60° SE	"	irrough	"	
44.	47 50°	70° NW	plane	smooth	closed	
45.	47 50°	68° NW	"	"	"	
46.	62 65°	74° NW	"	"	"	
47.	279 282°	13° NE	"	"	Part open	
48.	275 278°	73° N	curved	"	closed	
49.	319 322°	83° NE	"	"	"	
50.	318 321°	83° NE	"	"	"	
51.	17 20°	57° NW	Plain, smooth, open - slickensides - clay gouge oxidized to a yellow orange - zone is up to 6" wide, slickstip 62°			
52.	289 292°	27° SW	Plain	smooth	closed	
53.	335 338°	36° SW	"	"	"	
54.	295 298°	57° N	"	rough	Part open	
55.	44 47°	34° NW	"	"	open	

* Corrected readings marked in red.

*

56. 0 3°, 3° W, curved, irr, closed
57. 307 310°, 25° NE, plain, smooth, "
58. 52 55°, 68° NW, " , rough, "
59. 299 302°, 65° NE, curved " , closed
60. Gouge [illegible] strong physical and chemical [illegible] Zone [illegible] and jaunt to [illegible] ? Not plotted
61. 317 320°, 55° NE, plain, smooth, ?
62. 40 43°, 77° NW, " , " , closed
63. 19 17°, 51° W, " , " , "
64. 324 327°, 70° NE, " , " , "
65. 324 327°, 55° NE, " , " , "
66. 70 73°, 62° S, " , rough , "
67. 352 355°, 53° W, " , smooth , "
68. 318 321, 70° NE, " , " , "
69. 318 321, 14° NE, " , " , "
70. 42 45°, 75° NW, " , " , "
71. 41 41°, 75° NW, " , " , "
72. 330 333°, 1° SW, " , " , "
73. 0 3°, 66° W, " , rough , part open
74. 47 50°, 85° NW, " , smooth , closed
75. 319 322°, 7° NE, " , " , "
76. 312 315°, 74 NE, " , " , "
77. 299 302°, 88° NE, curved, rough, part open
78. 295 298°, 80° NE, plane, smooth, closed
79. 305 308°, 60° NE, curved, rough, open up to 1' (sample taken) Rock [illegible] weathered to [illegible] oxidized zones [illegible]
80. 80 83°, 12° N, plane, rough, part open

* Corrected readings marked mired

324
81. 327°, 55° NE 1' to 3'

Upstream end of this site is a green hornblende-rich andesite porphyry. It has white plagioclase phenocrysts and thus grades downstream into the diorite or quartz diorite

Plotted on rev sheet
DT; June 30 1987 TS

[illegible]	[illegible] 70°	plane	smooth	closed
291	293, 83° NE	"	"	"
355	358°, 44° W	"	"	"
338	341°, 28° SW	"	"	"
327	330°, 55° SW	"	"	"
340	343°, 27° SW	"	"	"
311	314°, 90°	"	"	"
321	324°, 68° SW	"	"	"
272	275°, 83° N	"	"	"
61	64°, 5° SE	"	"	"
301	304°, 87° NE	"	rough	?
325	328°, 22° SW	"	smooth	closed
76	79°, 21° SE	"	"	"
273	276°, 78 N	"	rough	part open
283	286°, 81° S	"	smooth	closed
337	340°, 18° NE	"	"	"
339	342°, 60° SW	"	"	"
294	297, 60° S	"	"	"
15	18°, 85° E	"	"	"
23	26°, 51° SE	curved	rough	part open
7	10°, 38° E	plain	"	"
41	44°, 88° SE	"	"	closed
26	29°, 90°	"	"	close spacing 1° to 3°
28	31°, 89° SE	curved	"	part open
284	287, 79° N	"	smooth	part open

[illegible]	[illegible]	[illegible]	smooth	open
340	343°, 85° E	"	rough	part open
313	316°, 13° SW	"	smooth	closed
9	12°, 19° E	"	rough	?
27	30°, 82° SE	"	smooth	closed
329	332°, 84° NE	curved	rough	"
287	290, 56° NE	plane	smooth	closed
273	276, 75° N	"	"	part open
50	53°, 17° SE	"	rough	closed
24	27°, 84° SE	"	smooth	"
285	288, 77 N	"	"	open
265	268°, 28° S	"	"	"
323	326°, 74° NE	curved	rough	closed
356	359, 62° E	plane	smooth	closed spacing 2° to 2°
354	357°, 70° E	plane	smooth	closed
0	0°, 70° E	"	"	"
246	249°, 82° NW	plane	rough	closed
329	332°, 65° SW	"	smooth	"
351	354°, 61° E	"	"	"
349	352°, 66° E	"	"	spacing 1° to 2.5°
288	291°, 78° NE	"	smooth	closed
289	292, 80° NE	"	"	part open
32	35°, 90°	"	"	closed
356	359, 60° E	"	"	"
287	290, 84° NE	"	"	"

* Corrected readings marked in red.

151

* 57 57	60°,	75 NW,	plain,	smooth,	closed
57 344	347°,	46° W,	"	"	"
57 75	78°,	75° NW,	"	"	"
347	350°,	28° W,	"	"	"
* 15	18°,	28 W,	"	"	Spacing = 6" to 1.5'
353	356°,	65° E,	"	"	Spacing = 2" to 1'
57	3°,	60° E,	"	"	"
57 356	359,	60° E,	"	"	"
57 54		87°	"	"	"
60 332	335°,	7° NE,	"	"	"
61					

Plotted on the red sheet June 30th, 1981 TS.

* seems to be the prominent joint set

This site is on the right abutment near the centerline, In the medium grained green-white (plagioclase) diorite or quartz diorite

10-2-80

Rained/snowed last night, overnight low of 18°. Dusting @ Watana. Work at Tsusena Creek the oxidized zone

10-80-297

1. 309 312°, 68° W, plane, smooth, closed, to stain — slight gouge
2. 302 305°, 84° NE, " rough " "

* Corrected readings marked in red.

P. open 1/8"

152

3.	312 5°,	67° SW,	plane,	rough,	closed,	Fe stain	1' to 1.5'
4.	29 300°,	54° SW,	"	"	"	"	
5.	307 310°,	65° SW,	"	"	"	"	
6.	87 90°,	47° N,	"	smooth,	"	"	
7.	327 330°,	82° NE,	"	rough,	p. open,	"	3" to 10"
8.	320 323°,	83° NE,	"	"	"	"	
9.	67 70°,	62° NW,	"	"	"	"	
10.	51 54°,	28° SE,	curved,	smooth,	"	"	
* 11.	324 327°,	72° SW,	plane,	rough,	gouge zone ~2' wide to stain		
12.	7 10°,	vert,	plane,	smooth,	p. open,		
13.	307 310°,	25° NE,	curved,	rough,	p. open,	gouge ~2"	
14.	327 330°,	55° NE,	"	"	closed,		
15.	7 10°,	87° SW,	plane,	smooth,	"	Fe stain	
16.	322 325°,	47° NE,	"	rough,	"	"	
17.	317 320°,	73° NE,	"	"	"	"	1' to 2.5'
18.	322 325°,	75° NE,	"	smooth,	"	"	
19.	312 315°,	72° SW,	curved,	rough,	p. open,	gouge zone 3" 6"	
20.	322 325°,	84° SW,	"	"	"	Fe stain	2"-8"
21.	319 322°,	75° SW,	"	"	"	"	
22.	17 20°,	vert,	plane,	smooth,	"	"	1'
23.	12 15°,	"	"	"	"	"	
24.	292 295°,	67° N,	curved,	rough,	?	"	& hemat
* 25.	92 95°,	45° N,	"	"	closed,	gouge zone	
26.	297 300°,	48° NE,	"	"	slicks - 18° W,	Fe, S	
27.	307 310°,	30° NE,	curved,	"	p. open,	Fe, S min	
28.	352 355°,	78° E,	"	"	"	Fe stain	8" gouge
29.	329 352°,	70° NE,	plane,	smooth,	closed	"	

Natural Trigonometrical Functions

Angle	Sin.	Tan.	Sec.	Cosec.	Cotg.	Cosin.	
° ′							° ′
32	.5299	.6249	1.1792	1.887	1.600	.84805	58
10	.5324	.6289	1.1813	1.878	1.590	.84650	50
20	.5348	.6330	1.1835	1.870	1.580	.84495	40
30	.5373	.6371	1.1857	1.861	1.570	.84339	30
40	.5398	.6412	1.1879	1.853	1.560	.84182	20
50	.5422	.6453	1.1901	1.844	1.550	.84025	10
33	.5446	.6494	1.1924	1.836	1.540	.83867	57
10	.5471	.6536	1.1946	1.828	1.530	.83708	50
20	.5495	.6577	1.1969	1.820	1.520	.83549	40
30	.5519	.6619	1.1992	1.812	1.511	.83389	30
40	.5544	.6661	1.2015	1.804	1.501	.83228	20
50	.5568	.6703	1.2039	1.796	1.492	.83066	10
34	.5592	.6745	1.2062	1.788	1.483	.82904	56
10	.5616	.6787	1.2086	1.781	1.473	.82741	50
20	.5640	.6830	1.2110	1.773	1.464	.82577	40
30	.5664	.6873	1.2134	1.766	1.455	.82413	30
40	.5688	.6916	1.2158	1.758	1.446	.82248	20
50	.5712	.6959	1.2183	1.751	1.437	.82082	10
35	.5736	.7002	1.2208	1.743	1.428	.81915	55
10	.5760	.7046	1.2233	1.736	1.419	.81748	50
20	.5783	.7089	1.2258	1.729	1.411	.81580	40
30	.5807	.7133	1.2283	1.722	1.402	.81412	30
40	.5831	.7177	1.2309	1.715	1.393	.81242	20
50	.5854	.7221	1.2335	1.708	1.385	.81072	10
36	.5878	.7265	1.2361	1.701	1.376	.80902	54
10	.5901	.7310	1.2387	1.695	1.368	.80730	50
20	.5925	.7355	1.2413	1.688	1.360	.80558	40
30	.5948	.7400	1.2440	1.681	1.351	.80386	30
40	.5972	.7445	1.2466	1.675	1.343	.80212	20
50	.5995	.7490	1.2494	1.668	1.335	.80038	10
37	.6018	.7536	1.2521	1.662	1.327	.79864	53
10	.6041	.7581	1.2549	1.655	1.319	.79688	50
20	.6065	.7627	1.2577	1.649	1.311	.79512	40
30	.6088	.7673	1.2605	1.643	1.303	.79335	30
40	.6111	.7720	1.2633	1.636	1.295	.79158	20
50	.6134	.7766	1.2661	1.630	1.288	.78980	10
38	.6157	.7813	1.2690	1.624	1.280	.78801	52
10	.6180	.7860	1.2719	1.618	1.272	.78622	50
20	.6202	.7907	1.2748	1.612	1.265	.78442	40
30	.6225	.7954	1.2778	1.606	1.257	.78261	30
40	.6248	.8002	1.2808	1.601	1.250	.78079	20
50	.6271	.8050	1.2838	1.595	1.242	.77897	10
	Cosin.	Cotg.	Cosec.	Sec.	Tan.	Sin.	Angle

Angle	Sin.	Tan.	Sec.	Cosec.	Cotg.	Cosin.	
° ′							° ′
39	.6293	.8098	1.2868	1.589	1.235	.77715	51
10	.6316	.8146	1.2898	1.583	1.228	.77531	50
20	.6338	.8195	1.2929	1.578	1.220	.77347	40
30	.6361	.8243	1.2959	1.572	1.213	.77162	30
40	.6383	.8292	1.2991	1.567	1.206	.76977	20
50	.6406	.8342	1.3022	1.561	1.199	.76791	10
40	.6428	.8391	1.3054	1.556	1.192	.76604	50
10	.6450	.8441	1.3086	1.550	1.185	.76417	50
20	.6472	.8491	1.3118	1.545	1.178	.76229	40
30	.6494	.8541	1.3151	1.540	1.171	.76041	30
40	.6517	.8591	1.3184	1.535	1.164	.75851	20
50	.6539	.8642	1.3217	1.529	1.157	.75661	10
41	.6561	.8693	1.3251	1.524	1.150	.75471	49
10	.6583	.8744	1.3284	1.519	1.144	.75280	50
20	.6604	.8796	1.3318	1.514	1.137	.75088	40
30	.6626	.8847	1.3352	1.509	1.130	.74896	30
40	.6648	.8899	1.3386	1.504	1.124	.74703	20
50	.6670	.8952	1.3421	1.499	1.117	.74509	10
42	.6691	.9004	1.3456	1.494	1.111	.74314	48
10	.6713	.9057	1.3492	1.490	1.104	.74120	50
20	.6734	.9110	1.3527	1.485	1.098	.73924	40
30	.6756	.9163	1.3563	1.480	1.091	.73728	30
40	.6777	.9217	1.3600	1.476	1.085	.73531	20
50	.6799	.9271	1.3636	1.471	1.079	.73333	10
43	.6820	.9325	1.3673	1.466	1.072	.73135	47
10	.6841	.9380	1.3711	1.462	1.066	.72937	50
20	.6862	.9435	1.3749	1.457	1.060	.72737	40
30	.6884	.9490	1.3788	1.453	1.054	.72537	30
40	.6905	.9545	1.3826	1.448	1.048	.72337	20
50	.6926	.9601	1.3865	1.444	1.042	.72136	10
44	.6947	.9657	1.3902	1.440	1.036	.71934	46
10	.6967	.9713	1.3941	1.435	1.030	.71732	50
20	.6988	.9770	1.3980	1.431	1.024	.71529	40
30	.7009	.9827	1.4020	1.427	1.018	.71325	30
40	.7030	.9884	1.4061	1.422	1.012	.71121	20
50	.7050	.9942	1.4101	1.418	1.006	.70916	10
	.7071	1.	1.414	1.414	1.	.70711	45
	Cosin.	Cotg.	Cosec.	Sec.	Tan.	Sin.	Angle

59. 35 349 40° E, Plane, smooth, closed 104
274
324 68° S, " rough, Part open, FeO2 stain
348 57° SW, " smooth, closed, "
62. 351 62° E, " " " "
63. 55, 32° SE, " " " FeO2 stain
321
64. 324, 66° S, " " " " H stain
15
65 18, 70° W, " " " H stain
325
66. 328, 75° SW, " rough, Gouge zone ±5" wide
7
67. 10°, 88° W, " smooth, closed, H stain
49
68. 5° SE, " " " " "
279
69. 282, 60° N, Plane, smooth, closed " —
326
70. 329, 90°, " rough, "
30
71. 310°, 18° NE, " " "
0
72. 0°, 75° W, curved " " FeO2 stain
329
73. 352°, 83° NE, Plane, rough, Gouge zone
291
74. 294, 69° NE, " " " " FeO2 stain
317
75. 320°, 82° SW, " " 18"
324
76. 327, 73° SW, " smooth, closed,
51
77. 60° 49° SE, " " " "
347
78. 310° 87° NE, curved, rough, Alteration
9
79. 12°, 82° W, Plane, smooth, closed
24
80. 27° 46° E, " " " "
93
81. 90° 62° N, curved, rough, closed - chloritic
291
82. 293°, 8° NE, Plane, smooth, closed, Gouge zone 2" 6"
282
83. 285, 50° NE, " " part open, (closed 3" W
324
84. 327°, 70° SW, " " closed
69
85. 7° 41° SE, " rough, closed
292
86. 295, 75° NE, Plane, smooth, closed
277
87. 280, 63° NE, " " closed
312
88. 315°, 63° NE, Plane, smooth, closed
302
89. 305°, 54° NE, " " "

* Corrected readings marked in red

30.	32 [illegible]	65° SW	curved	smooth	closed	Fe stain
31.	217	66° SE	"	"	proper	"
32.	314°	69° NE	"	smooth	p. open	S, Fe
33	0°	65° NE	" nylonite	"	"	"
34.	324 327°	72° NE	"	rough	"	"
35.	224 227°	86° SE	curved	rough	"	gouge zone
36.	352 355°	65° E	plane	smooth	p. open	Fe stain
37.	352 355°	65° E	curved	"	closed	S
38.	337 340°	73° E	"	rough	"	Fe, S
39.	332 335°	58° SW	plane	smooth	"	"
40.	322 325°	56° SW	"	"	"	"
41	342 345°	60° NE	"	rough	"	"
42.	342 345°	54° NE	"	"	"	"
43.	327 330°	47° SW	plane	"	"	"
44	334 337°	52° NE	"	"	"	"
45.	312 315°	55° SW	"	smooth	"	"
46	315 318°	54° SW	"	"	"	"
47.	325 328°	56° SW	"	"	"	"
48.	315 318°	48° NE	"	"	"	"
49.	344 347°	60° SW	"	"	"	Fe stain
50.	324 327°	62° NE	"	"	p. open	"
51.	31 34°	88° NW	"	rough	closed	Fe O_2 St.
52.	50 53°	43° NW	"	smooth	"	"
53.	41 44°	37° NW	"	"	"	"
54.	324 326°	60° SW	"	"	"	"
55.	333 336°	34° NE	"	"	"	—
56.	349 347°	36° SW	curved	"	"	Gouge zone between 56 & 57
57.	325	Missing ?				
58.	328°	66° SW	plane	"	"	Fe O_2 stain

* Corrected readings [illegible] in red

CURVE TABLES

HOW TO USE CURVE TABLES

4"–8"

Table I. contains Tangents and Externals 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 ÷ 12 = 10.07. Say a 10° Curve.

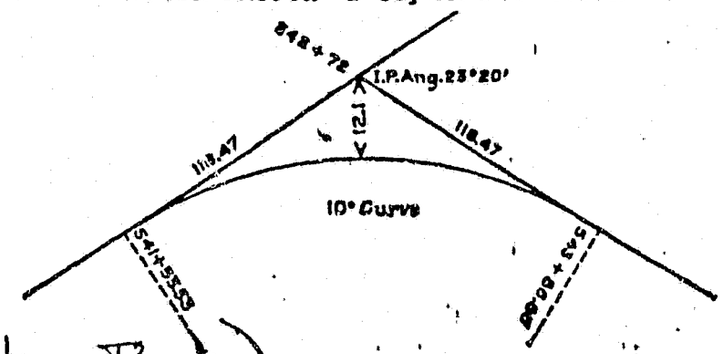
Tan. in Tab. I opp. 23° 20′ = 1183.1
1183.1 ÷ 10 = 118.31.

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° ÷ 10 = 2.3333 = L. C.

2° 19½′ = def. for sta.	542	I. P. = sta.	542+72
4° 49½′ = " " "	+50	Tan. =	1 .18.47
7° 19½′ = " " "	543	B. C. = sta.	541+53.53
9° 49½′ = " " "	+50	L. C. =	2 .33.33
11° 40′ = " " "	543+ 86.86	E. C. = Sta.	543+86.86

100 − 53.53 = 46.47 × 3′ (def. for 1 ft. of 10° 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.



(cont on Back)

81 [illegible] curved, [illegible] 165 77

345 345°, 22° [illegible], Irr, Rough, Gouge zone [illegible]

58 [illegible]°, 78° NW, curved, smooth, part open

86 89°, 73° NW Plane, smooth, closed

347 350°, 16° W, Plane, rough, "

279 282°, 71° NE, " , smooth, part open

312 315°, 78° SW, Plane, smooth, closed

277 280°, 46° NE, curved, " , part open FeO_2 50% [illegible]

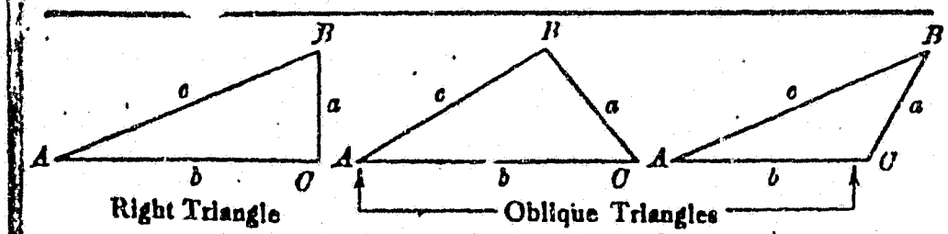
Z 5°, 89° [illegible] Plane, " , closed, "

309 312°, 58° NE, " , part open

323 326°, 53° NE, " , [illegible] closed [illegible]

Plotted on Thered Sheet TS
At June 30th, 1981

TRIGONOMETRIC FORMULÆ



Solution of Right Triangles

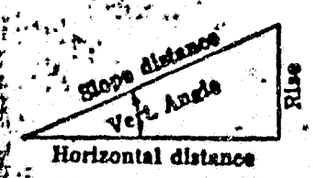
For Angle A: $\sin = \frac{a}{c}$, $\cos = \frac{b}{c}$, $\tan = \frac{a}{b}$, $\cot = \frac{b}{a}$, $\sec = \frac{c}{b}$, $\operatorname{cosec} = \frac{c}{a}$

Given	Required	
a, b	A, B, c	$\tan A = \frac{a}{b} = \cot B,\ c = \sqrt{a^2+b^2} = a\sqrt{1+\frac{b^2}{a^2}}$
a, c	A, B, b	$\sin A = \frac{a}{c} = \cos B,\ b = \sqrt{(c+a)(c-a)} = c\sqrt{1-\frac{a^2}{c^2}}$
A, a	B, b, c	$B = 90° - A,\ b = a\cot A,\ c = \frac{a}{\sin A}$
A, b	B, a, c	$B = 90° - A,\ a = b\tan A,\ c = \frac{b}{\cos A}$
A, c	B, a, b	$B = 90° - A,\ a = c\sin A,\ b = c\cos A$

Solution of Oblique Triangles

Given	Required	
A, B, a	b, c, C	$b = \frac{a\sin B}{\sin A},\ C = 180° - (A+B),\ c = \frac{a\sin C}{\sin A}$
A, a, b	B, c, C	$\sin B = \frac{b\sin A}{a},\ C = 180° - (A+B),\ c = \frac{a\sin C}{\sin A}$
a, b, C	A, B, c	$A+B = 180° - C,\ \tan\frac{1}{2}(A-B) = \frac{(a-b)\tan\frac{1}{2}(A+B)}{a+b},\ c = \frac{a\sin C}{\sin A}$
a, b, c	A, B, C	$s = \frac{a+b+c}{2},\ \sin\frac{1}{2}A = \sqrt{\frac{(s-b)(s-c)}{bc}},\ \sin\frac{1}{2}B = \sqrt{\frac{(s-a)(s-c)}{ac}},\ C = 180° - (A+B)$
a, b, c	Area	$s = \frac{a+b+c}{2},\ \text{area} = \sqrt{s(s-a)(s-b)(s-c)}$
A, b, c	Area	$\text{area} = \frac{bc\sin A}{2}$
A, B, C, a	Area	$\text{area} = \frac{a^2\sin B\sin C}{2\sin A}$

REDUCTION TO HORIZONTAL



Horizontal distance = Slope distance multiplied by the cosine of the vertical angle. Thus: slope distance = 319.4 ft. Vert. angle = 5° 10′. From Table, Page IX. cos 5° 10′ = .9959. Horizontal distance = 319.4 × .9959 = 318.09 ft.

Horizontal distance also = Slope distance minus slope distance times (1 − cosine of vertical angle). With the same figures as in the preceding example, the following result is obtained. Cosine 5° 10′ = .9959. 1 − .9959 = .0041. 319.4 × .0041 = 1.31. 319.4 − 1.31 = 318.09 ft.

When the rise is known, the horizontal distance is approximately:—the slope distance less the square of the rise divided by twice the slope distance. Thus: rise = 14 ft., slope distance = 302.6 ft. Horizontal distance = $302.6 - \frac{14 \times 14}{2 \times 302.6} = 302.6 - 0.32 = 302.28$ ft.

SUSITNA
HYDROELECTRIC
PROJECT
P 5701.05

AMI BOOK # 4
1980

PEDERSEN

P 5701.05
Devil Canyon B # 4
D PEDERSEN

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JOINT SET MEASUREMENTS 1-3

8/16/70

1.

[#5,1]

Mapping around Devil's Canyon area during reconnaissance geology and strategy preparation.

D80-1

Dark gray argillite breaks w/ conchoidal fracture very low degree of slaty cleavage in a compact of pebbles. Weathers offwhite, buff colored to brown.

X 14°, 84°E closed joint plain
2. 8°, 85°E " " "
3. 323°, 56°SW " " "
4. 12°, 83°E " " "
5. 54°, 74°SE " " Sightly irregular
6. 27°, 83°SE " " "
7. 338°, 89 NE open Joint Plain
8. 357°, 86°E Slightly irr. plain open
9. 323, 29°SW Plain, closed
10. 60°, 15°NW Plain
11. 44°, 87°NW Plain - open
12. 108°, 38°N Smooth to slightly irr.

2.

13. 295°, 70°S ?
14. 0°, 81°E Plain closed
15. 344°, 90° Plain closed
16. 339°, 87°NE closed plain
17. 92°, 86°S Plain closed smooth
18. 315°, 56°SW Plain, closed
19. 328°, 82°NE Plain, closed?
20. 64°, 75°SE slightly irr. Plain smooth
21. 65°, 86°SE Part open plain smooth
22. 57°, 66°SE Plain, smooth, closed
23. 4°, 83°E closed, smooth, plain
24. 97°, 87°S slightly irr smooth
25. 69°, 53°SE plain, smooth, closed
26. 79°, 11°N slightly irr. plain, closed
27. 290°, 41°N-NE " " " smooth, closed
28. 10°, 83°E, Plain, smooth, closed.
29. 130°, 78°E slightly irr. plain, closed
30. 356°, 90° irr. plain, rough
31. 3°, 90° plain, closed, smooth
32. 314°, 84 SW part open, plain smooth
33. 30°, 31°SW part open plain sl. irr.
34. 54°, 75°SE slightly irr. curved closed?
35. 9°, 87°E plain closed smooth
36. 75°, 73°SE Slightly curved irr. smooth
37. 308°, 30°SW part open sl. irr. smooth

38. 66°, 74° SE - Part open, sl. irr., smooth
~~39.~~ 304°, 32° SW " " , Plain, " /
40. 315°, 83° NE curved, closed, irregular /
~~41.~~ 73°, 17° N ?
~~42.~~ 33°, 71° SE curved, smooth closed /
~~43.~~ 91°, 29° N sl. irr., smooth closed /
~~44.~~ 342°, 69° N plain smooth closed /
~~45.~~ 323°, 85° NE part open plain smooth /
~~46.~~ 54°, 72° SE curved, part open, irregular /
~~47.~~ 215, 21° N closed, irregular, plain /
~~48.~~ 310°, 82° NE plain, smooth, closed /
~~49.~~ 274, 80° SW sl. irr., plain, ?
~~50.~~ 49°, 71° SE sl. irr., curved, ?/
~~51.~~ 267°, 21° S pl., irr., closed

(8/19/80) [*5,3]

Devils Canyon - hiked over above and across Avicina from the landing strip.

D.80-2 Dark grey argillite exhibiting some very sedimentary cleavage. Pyrite cubes. Quartz stringers. Weathers rough. Small structures include ptygmatic folds - Bedding mutation is 63°, 51° SE

D.80-3

In Mikes notes - I took measurements and he took notes at this site.

D.80-4

Dark grey argillite marginally phyllite w qtz blebs and pyrite cubes

1. 342° - 74° NE
2. 340° - 74° NE

D.80-5 - Dark grey argillite containing clastic fragments of milky qtz, pyritized phyllite, and fine gr. quartzite. Argillite weathers to a slate grey. Clasts range in size from 1 to 5 cm.

1. 348, 85° NE 6" to 8'
2. 62°, 90° 2" to 4'
3. 75°, 89° NW
4. 120°, 15° S 1' to 5'

5. 349, 23°E
6. 342°, 81°E 2' to 4'
7. 76°, 81°N
8. 275, 19°S } 8' wide badly fractured vertical section.
9. 347, 84°E } 2" to 1"

D. 80 - 6

Dark grey to charcoal black argillite displaying grain linearity and sedimentary [illegible]. Weathers slate grey.

1. 344, 74°E } 1" to 1' - highly fractured
2. 347°, 67°E }
3. 377°, 68°S
4. 37°, 23°NW } 1" to 6" -
5. 15°, 25°NW }

D. 80 - 7 - Red-grey argillite w/ stringers of quartz - massive weathers slate grey. [illegible] grain linearity

D. 80 - 8

Dark grey argillite slightly phyllitic, weathers to slate grey, massive.

D80 - 9 Grey brown argillite w/ pyrite cubes. Weathers to a light slate grey. Exhibits grain linearity.

D80 - 10 Maroon - grey argillite, weathers light grey, exhibits grain linearity

D80 - 11
Glacial - Mike

D. 80-12

Grey argillite to phyllite w/ sty stringers and FeO_2 stain on weathered surface. Pyrite cubes. noticed a small chlor zone at this location 95°, 72° NW. Photo # 25

elev. 5115' 4:00 PM

This is a small outcrop ≈ 40' above the river talus slope extends both above and below outcrop and are unvegetated.

1. 178°, 77° S
2. 276°, 78° S

D. 80-13

light grey to white pinkish grey rock with numerous sty eyes. Porphyritic felsic dike rock w/ phenocrysts of Kspar, albite, sty. Unable to obtain an orientation but this dike is very steeply dipping. Weathers into small blocky pieces with buff colored to iron stained surfaces.

(8-23-80) Page 18 in book #5

Working on both R and L abutments just downstream from dam axis.

D-80-15

Grey argillite - a slight phyllitic luster - weathers dark grey w/ FeO_2 stain. Highly fractured.

I took joint measurements and Mike put them in his notes

D-80-16

At this site there are two rock types

1. An argillite which has developed a granoblastic texture, apparently due to contact metamorphism. Adjacent the argillite is a fine to med gr. granodiorite to diorite w/ biotite, albite and subordinate kspar. The granodiorite is not definitely in place but appears to be a xenolith along an SW trending strike - 100°. The argillite dipping

well developed eyes of quartz and a coarsely platy texture

D 80-17 -

Contact between granodiorite to qtz diorite dike rock and dark grey argillite which is seen contact metamorphosed to a grey green almost sugary textured rock w/ concentration of qtz. A little farther along the outcrop the argillite is metamorphosed into a phyllite to subschistose rock. This contact appears gradational in both the host rock and the dike rock.

D-80-16 Revisited & continued

Joint Orientations

1. 284°, 72°S
2. 21°, 83°SE

D-80-18

Dark grey phyllite with bedding oriented 78°, 50°SE, 79°, 54°SE. Weathers to dark grey black w/ some FeOx stains. Outcrop is 30' long and 8' wide.

1. 4°, 80° NW

D. 80-19

Grey biotite granodiorite outcrop fairly well exposed the top of a small hill ≈ 175' x 175'. Texture is inequigranular with larger phenocrysts of plagioclase (albite). Not in a finer grained groundmass of albite and orthoclase. Qtz is dispersed throughout the rock ≈ 15%, G.I. ≈ 15. Weathers grey.

D80-20

Dark grey argillite - outcrop [illegible] area of small hill x 200' x 200' [illegible] [illegible] w/ conchoidal fracture [illegible] there appears to be tiny qtz eyes throughout as well as stringers of qtz. Weathers light grey.

1.

D-80-21

Dark grey argillite - [illegible] [illegible] of conchoidal fracture - stringers of qtz exhibiting [illegible] folds. Also [illegible] [illegible] of pyrite. In places the argillite is [illegible] to a much lighter rock w/ FeO_2 stain.

1. 320°, 60°N
2. 72°, 47°SE
3. 34°, 88°W

Also at this outcrop is an exposure of what looks like a meta [illegible] [illegible] [illegible].

A little further upstream a granodiorite dike was found in contact w/ the quartzite looking rock and the argillite. It is possible that the quartzite is in reality a contact metamorphosed argillite.

D80-22

Nonconformity - contact between granodiorite and argillite. It is easy to see the contact in outcrop because the argillite is intensely sheared whereas the granodiorite is fairly massive. There is at the contact a light quartzite zone which represents contact metamorphism of the argillite. Radiating outward from the granodiorite into the argillite are numerous quartz veins and stringers of various sizes.

C. 80-23

Dark grey argillite displaying some grain linearity and breaking with a conchoidal fracture. Weathers to a medium gray and is massive in outcrop.

2 Major joints
1. 55°, 57° SE 8" to 4'
2. 336°, 66° NE 1' to 3'
3. 285°, 73° SE
4. 72°, 64° NW
5. 76°, 64° SE
6. 315°, 80° S

Outcrop is ≈ 75' above the river ≈ 200' long and 35' high.

8/[illegible]/80 Thursday

Devil Canyon Area to the North. Very cloudy and foggy today. Fresh snow approx 800' lower than yesterday - Chilly.

D. - 80-24

Dark grey meta argillite with reddish cast. Displays some grain linearity. Disseminated qtz stringers and veinlets. Outcrop is ≈ 20' long and 5' [illegible] wide. Weathers light grey - massive.

1. 346°, 83° SW 3" to 1'
2. 96°, 90° 4" to 2'
3. 65°, 35° SE 3" to 1'
4. 338°, 84° SW 3" to 1'
5. 94°, 89° NW 4" to 2'

D. - 80 - 25

Grey meta argillite displaying some grain linearity. Disseminated qtz stringers and veinlets. Weathers to a light grey. Outcrop is ≈ 15' long 3' wide. Not possible to obtain joint orientations because this surface has been glaciated.

D-80-26

Dark grey meta argillite w/ disseminated qtz stringers. Massive & blocky. Some grain linearity. Weathers light grey. Breaks with conchoidal fracture.

1. 94°, 58° NW 6" to 1.5'
2. 90°, 80° NW " " "
3. 350°, 82° E 4" to 2'
4. 65°, 48° NW " " "

D-80-27

Dark grey meta argillite w/ some grain linearity. Massive & blocky. Weathers to a light grey. Breaks with conchoidal fracture.

1. 97°, 76° NW 4" to 2'
2. 22°, 72° SW 6" to 1.5'
3. 64°, 58° NW 4" to 2'
4. 93°, 74° NW 4" to 2'
5. 39°, 88° NW 8" to 1.5'
6. 0°, 80° E 8" to 1.5'

D-80-28

Dark grey meta argillite w/ reddish cast, and some grain linearity. Disseminated qtz stringers. Weathers to a light grey. Blocky and massive.

1. 356°, 82° NE
2. 110°, 80° N
3. 30°, 84° E

D-80-29

Dark grey meta-argillite displaying some grain linearity. Disseminated quartz stringers in places opposing stygmatically folded. Weathers to a light grey. Outcrop is ~50 ft long and 6' high.

1. 4°, 78° NE
2. 350°, 80° NE
3. 65°, 56° NW
4. 41°, 90°

D.-80-30

Dark grey meta-argillite with some grain linearity. Quartz stringers. Weathers to a light grey. Massive and blocky.

1. 4°, 80° NE 6" to 2'
2. 323°, 90° " " "
3. 354°, 84° NE " " "
4. 0°, 78° E 6" to 2'

D.-80-31

Dark grey meta argillite. Some grain linearity. CO_2 stain on some weathered surfaces. Weathers to a light grey. [illegible] and blocky

1. 348°, 86° SW
2. 300°, 85° N
3. 85°, 86° NW

D.-80-32

Dark grey meta argillite as at D.80-31 - Very difficult to obtain joints at this site due to glacial rounding. Also noticed a small lenspike mass of fine grained light colored siliceous material resembling meta arenite w/ qtz eyes.

D.80-33

Dark grey meta-argillite. Some grain linearity. Quartz stringers. Weathers to a light grey. Blocky & massive

1. 330°, 80° SW 4" to 2'
2. 337°, 83° NE 4" to 2'
3. 85°, 24° SE 6" to 1.5'
4. 298°, 85° N 4" to 2'
5. 345°, 65° NE " " "

D-80-34

Dark grey meta argillite. Some grain linearity - Quartz stringers. Weathers to a light grey. Blocky and massive. Outcrop 2-40' long and 10' feet high

1. 115°, 90°
2. 105°, 90°
3. 42°, 80° E
4. 10°, 36° SW
5. 40°, 84° E

* 68°, 28° SE is the bedding orientation

D-80-35

Dark grey meta argillite w/ some grain linearity. Occasional quartz stringers. Weathers light grey and is massive and blocky. Glaciated surface at this location is difficult to obtain orientation on.

1. 55°, 82° NW 2" to 1.5'
2. 340°, 90° " " "
3. 96°, 85° SE " " "

D-80-36 -

Dark grey meta arg. essentially the same as at station D80-35

1. 295°, 80° N
2. 87°, 90°
3. 305°, 88° S
4. 60°, 85° SE

Outcrop is 20' high and 100' long.

D-80-37

Dark grey meta argillite containing a zone of white siliceous rock resembling meta arenite and with numerous qtz eyes. Hand specimen taken.

1. 82°, 77° SE
2. 70°, 78° SE
3. 300°, 85° N
4. 330°, 87° SW

Outcrop is ≈30' long and 12' wide - it is not possible to determine the aerial extent of the felsic material in outcrop but it appears to be relatively small ≈ 5' wide and of indeterminate length. This material is more highly fractured than the argillite.

D-80-38 -

Dark grey meta argillite showing some linearity of grains. Weathers w/ conchoidal fracture and contains qtz. stringers. Also and in contact w/ the argillite at this station is more of the felsic qtz rich rock seen at station #37

1. 44°, 87° E
2. 35°, 72° E
3. 345°, 89° NE
4. 349°, 20° SW

Hand specimen taken

The strike of this felsic material appears to be ≈ 350° the dip is indeterminate

D-

D-50-39

Dark grey meta Argillite. Some grain linearity & qtz stringers. Weathers light grey, massive & blocky

1. 330°, 87°N ≈ 2" to 1.5'
2. 308°, 85°S = " " "
3. 330°, 87°N = " " "
4. 33°, 67°W = " " "

D 80-40

Dark grey meta argillite - w/ qtz stringers. Some grain linearity exhibited. Weathers to a light grey

1. 0°, 74°NE
2. 45°, 90°
3. 3°, 74°NE

D80-41

Dark grey meta argillite, some grain linearity. Qtz itic veinlets with a green caste to them. Conchoidal fracture - massive & blocky. Weathers light grey

1. 305°, 68°N
2. 2°, 78°NE
3. 15°, 90°

SE of Devils Canyon Damsite

[25, 31]

D 80-42

Grey granodiorite - C.I. ≈ 15, [illegible] qtz, Kspar ? plag ? [illegible] high and several [illegible]

D 80-43

Dark grey argillite - slightly [illegible] & thinly bedded. Occasional qtz veins. Weathers to a light grey. Some FeO_2 stain on joint surfaces

1. 98°, 64°S } bedding 2" to 1'
2. 94°, 64°S
3. 15°, 76°W 1" to 1'
4. 7[illegible]°, 48°NW 1" to 1'

D80-44

Here we see a contact [illegible] granodiorite and argillite. The granodiorite is a biotite granodiorite. C.I. ≈ 18, % ≈ 18, Plag = ?, Kspa = ?. The argillite at the contact is light buff or eggshell color and is thinly bedded breaking with an almost slaty cleavage. This contact zone is ≈ 2' wide and lies at 345°, 32° NE. Beyond this fissile contact the argillite becomes gradually darker and more massive though it still contains numerous qtz. eyes 30' from the actual contact zone.

1. 90°, 60° SE ≈ 2" to 2'
2. 95°, 70° SE ≈ " " "
3. 0°, 78° W ≈ " " "
4. 95°, 70° N ≈ " " "

The granodiorite at the contact, [illegible] a [illegible] zone of finer grained gd. with a higher color index ≈ 25 as compared with the C.I. of ≈ 18 for the coarser gd. that does not contact the argillite

Hand specimens taken

D80-45

Med grained biotite granodiorite C.I. ≈ 20. Weathers massive and blocky. This gd. is a little finer grained and a little darker probably due to contamination by argillite.

1. 74°, 90° 2" to 5'
2. 318, 34° SW 2" to 3'
3. 330°, 64° N 2" to 3'

1805' Elev. at 11:45 PM

D80-46

Grey-biotite granodiorite med. grained. C.I. ≈ 20. Weathers massive. No large degree of shearing is seen at this outcrop

1. 340°, 80° SW
2. 83°, 88° NW
3. 332, 80° SW
4. 70°, 89° NW

El. 1950 at 1:00 PM

D80-47

Pinkish grey biotite granodiorite. C.I. ≈ 15%, % qtz ≈ 18%. Weathers to a light pinkish grey. Massive & blocky.

1. 318°, 90°
2. 328°, 80° SW
3. 22°, 60° W
4. 70°, 70° SE

Elevation 1665 at 12:45 PM

1890'

D-80-48

Med grained grey biotite granodiorite. CI = 20. Weathers to a pinkish grey. Massive and blocky. Outcrop is ≈ 100' long and 10' high

1. 80°, 81° SE
2. 307°, 64° NE
3. 80°, 54° NW
4. 70°, 82° SE
5. 55°, 85° SE

Elevation is 1890' at 1:15 PM

D80-49 A

Grey med. gr. biotite granodiorite CI ≈ 15% weathers massive and blocky.

1. 22°, 85° NE
2. 25°, 90°
3. 5°, 0°

Almost fell off outcrop dropped beanton 20'

D80-49 B

Med. to crse grained muscovite granite qtz approx. 40% +. There is a lot of partially assimilated meta argillite in places these xzenoliths have been contact metamorphosed to phyllites and schistose textures.

Hand specimens taken. Outcrop is weathered massive and blocky. Weathered granite has a light grey to eggshell colour

1. 54°, 88° NW
2. 318°, 38° NE
3. 53°, 90°
4. 54°, 87° NW

Xzenoliths range in size from 1cm to several meters in one plane but are generally less than 30 to 50 cm thick.

Elevation is 2355 at 2:20 PM

D80-50

Dark grey meta argillite - badly brecciated and sheared w/ considerable iron staining. The shear zone encompasses the entire outcrop and no definite shear orientation is possible. However I have taken down what I feel to be the prominent orientation 30°, 55° NW.

Major joint orientations include
1. 312°, 77° SW
2. 40°, 72° SE
3. 45°, 90°

Elevation 860' at 250 PM

D80-51

Dark grey meta argillite some grain linearly is displayed. Weathered light grey. Moderately well fractured, not possible to determine bedding at this outcrop.

1. 347°, 65° NE
2. 94°, 85° NW
3. 12°, 53° W
4. 36°, 48° E

850' at 325 PM

B 3180 - Portage Creek Reconnaissance

[#5, 35]

D-80-52

Dark grey meta argillite with some grain lineation developed. This argillite is cut by zone of catacleastic approx 2' wide exhibiting - mylonite, slow and thorough brecciation of host rock. Shear is oriented at 342°, 75° NE. I can pick up no slickensides within the shear zone but outside of the shear zone and almost at a right angle to it are slickensided surfaces at 55°, 75° SE.

Major joint orientations include
1. 45°, 55° NW 2" to 1.5'
2. 335°, 88° NE " "
3. 315°, 88° NE " "

I have located a diabase dike as well at this outcrop which parallels the strike of and is in close proximity to the sheared argillite. This dike is several feet thick and may have been the cause of some of the alteration at the shear zone.

There is a second shear zone black & grey which is approx 10' south west of the 1st described zone it lies at 35°, 75° NW and appears to be striking

directly toward the shear zone at D80-50. The bedding in the meta argillite appears to be oriented at 353°, 73° NE and it is not possible to discerne in this outcrop whether they are overturned or not.

4. 318°, 84° NE
5. 319, 89° SW

Elevation at 9:00 AM is 882'

D80-53

Dark grey argillite displaying some grain lineation. Weathers lighter grey w/ FeOx stain on weathered surfaces. This argillite is cut by a shear zone ≈ 2' wide and oriented at 330°, 85° SW. The North side of the shear zone is bounded by a light colored pelsic looking rock w/ grey [illegible]. This lighter colored rock is badly jointed (hand specimen taken). Much of the argillite to the North of this pelsic appearing rock is badly broken up, indicating a fairly large shear zone.

1. 90°, 80° NW ≈ 1" to 1'
2. 75°, 80° NW ≈ 1" to 1'

3. 7°, 80° W ≈ 1" to 1'
4. 60°, 74° NW ≈ 1" to 1'

Elevation at 10:30 PM is 880'

D80-54

Dark grey meta argillite displaying some grain linearity breaks w/ conchoidal fracture. Weathers to a light grey. Blocky & massive. Bedding appears to be oriented at 332°, 68° NE.

1. 324°, 77° S ≈ 2" to 1'
2. 348°, 80° SW ≈ " " "
3. 55°, 82° SE ≈ " " "
4. 335°, 84° SW ≈ " " "

Elevation is 895' at 11:00 PM

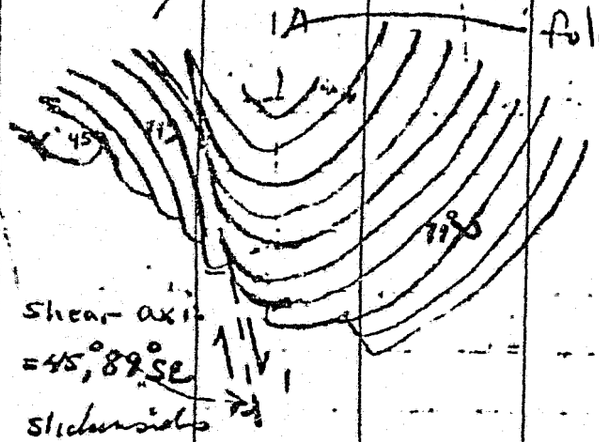
D80-55

Dark grey argillite displaying some grain linearity. Bedding appears near vertical and is possibly overturned. The argillite weathers to a light grey and is blocky and massive. Outcrop is ≈ 40' long and 12' high. Orientation of bedding lies at ≈ 307°, 66° SW

1. 15°, 17° W
2. 325°, 77° SW
3. 333°, 74° SW
4. 4°, 62° E

D80-56

Dark grey meta-argillite. Very little grain lineation, breaks with a conchoidal fracture. Weathers to a light grey. The argillite is isoclinally folded and possibly overturned there as slippage along bedding planes during folding and some minor shearing across bedding planes also is evident. The axis of the fold and of the shear is pictured below.



Bedding plane orientations vary from
1. 54°, 84° SE
2. 289°, 79° SW indicating an overturned fold
This outcrop is ≈ 30' long and 10' high.
3. 45°, 85° NW
Elevation at 12:35 is 925'

D80-57

Dark grey meta-argillite - little grain linearity. Weathers to a light grey. Breaks with a conchoidal fracture and is massive and blocky.

Bedding plane orientation is
1. 337°, 57° SW
2. 346°, 64° SW

Major joint orientations are
1. 93°, 74° S
2. 82°, 33° NW
3. 76°, 80° NW

Elevation at 1:25 is 920'

D80-58

Dark grey meta-argillite. Very little grain linearity. Weathers to a light grey; massive and blocky. FeO_2 stain on some joint surfaces. Breaks w/ conchoidal fracture. Bedding is oriented at 20°, 57° NW

Major joints include
1. 124°, 90°
2. 8°, 27° E
3. 124°, 83° S

D80-9-f

Dark grey argillite - displaying some well developed grain linearity. Weathers to a light grey w/ a little FeO_2 stain on some joint surfaces. Massive and blocky

1. 299°; 80° W = Plane of bedding
2. 340°; 82° SW
3. 25°; 27° SE
4. 326°; 85° N

Elevation is 974' at 2:40 PM

5:00 PM Elevation at Waters is 2,278'

8/24, T-6 [#5,37]

Mapping of old access road leading to Eastern edge of Southern abutment of Devils Canyon Damsite

D80-60

Dark grey slightly phyllitic meta-argillite. Weathers to a light grey with FeO_2 stain on some joint surfaces. Bedding is oriented at 63°, 39°SE. The major joints include

1. 354°, 82°SW 6" to 2'
2. 316°, 67°NE 8" to 1.5'
3. 355°, 90° 6" to 2'

This outcrop is ≈ 15' wide and 15' tall, massive and blocky.

D80-61

Light grey granodiorite C.I. ≈ 7, qtz ≈ 15%. Fine grained mesocrystalline. Weathers to an off white color and is massive. There is also a contact at one outcrop of meta argillite and granodiorite. Because of the fine grynature of this qd. I'm not sure at this time whether or not these small outcrops represent a smaller localized

inclusion of granodiorite into the phyllite or whether we are approaching the main body of the granodiorite.

1. 332°, 96°
2. 115°, 80°N
3. 338°, 88NE
4. 340°, 89°NE

Upon further discovery I find that the granodiorite was just a small body 10' to 20' wide extending into the argillite.

D80-62

Dark grey somewhat phyllite meta-argillite with disseminated qtz stringers. Weathers to a light grey. Massive and blocky.

D80-63 - In Mike's Notes

D80-64

light grey biotite, granodiorite, med grained. CI ≈ 17. Qtz ≈ 18%. FeO_2 Stain on some joint planes. Weathers off white to light grey. Massive.

D80-65

Dark grey meta argillite. Slightly phyllitic w/ distinct green linearity. Weathers to light grey, massive & blocky

D80-66

Dark grey phyllite argillite w/ distinct linear qtz aggregations, light grey on weathered surfaces. Some FeO_2 stain on joint surfaces.

1. 22, 82° E
2. 82° 77° N
3. 78°, 70° NW Questionable

A biotite granodiorite dike cuts through the argillite for about 30' at an unknown orientation.

D80-67

Dark grey phyllite w/ quartz stringers. The phyllite is the same as the nearby argillite but is in close proximity to a granodiorite pluton and has subsequently been metamorphosed to a higher grade. It weathers to a light grey.

D 80-[illegible]8

At this location there is an interfingering and partial assimilation of phyllite dark grey argillite by biotite granodiorite. The weathering surface is from off-white to light grey | Weathers massive and blocky.

1. 111°, 65° N
2. 114°, 69° N
3. 80°, 48° SE

This outcrop is ≈ 15 feet long 10' high. This station and the previous three stations lie on the North side of a small valley. Across the valley on the other side appear outcrops of massive granodiorite.

4. 77°, 60° NW

Elevation at 4:04 PM is 1,850', 69° F

D80-70

Tan or buff colored felsic like material w/ qtz eyes. This material looks like a clean qtzose meta sand stone w/ sacharoidal texture but was I believe a late stage siliceous liquor which was injected into the argillite from the nearby granodiorite plutons

8/[illegible]/80 - Tuesday [#5, 46]

Mapping of left abutment at Devils Canyon from the airstrip up and west along the abutment

D-80-69

Dark grey meta argillite displaying some grain linearity but still sub phyllitic. FeO_2 stain on some joint surfaces. Weathers to a light grey. This dissimilar qtz, stringers and veinlets. Outcrop is ≈ 20' long and 50' high massive and blocky.

Major joints include

1. 335°, 80° NE	4" to 3'
2. 83°, 58° SE	1" to 3'
3. 337, 83° NE	4" to 3'
4. 50, 62° SE	1" to 3'
5. 323, 84° NE	4" to 3'
6. 85°, 60 SE	1' to 3'

Pyrite cubes are also present in this sub phyllitic meta argillite. Near the top of this outcrop the argillite is infiltrated by quartz veinlets up to 2" thick

7. 347°, 87° SW	1" to 1'
8. 95°, 52° S	1" to 1'

D80-70

Tan to buff colored felsic dike material w/ qtz eyes. This material looks like a clean qtzose meta sandstone but was in actuality a late stage siliceous liquor which was injected into the argillite from the nearby granodiorite pluton and quickly cooled. This outcrop is very highly fractured w/ little preferred joint orientation with -107°, 52° S being the most obvious trend. This outcrop is ≈ 20' long and 6' high. It lies in a depression between to outcrops of Kag.

D80-71

Dark grey meta argillite displaying some grain linearity by sub phyllitic. There are some small qtz stringers and veinlets present. The argillite weathers to a light grey and is massive and blocky. This outcrop is ≈ 15' long and 10' high

1. 338°, 87° SW	2" to 1' some joints of this orientation are open up to 5"
2. 85°, 60° SE	1" to 1'

3. 25°, 52° SE = Plane of bedding

4 3. [illegible] 0 [illegible]
5 333°, 88° SW " " "

D80-72

Dark grey meta argillite displaying some green linearity. Weathers to a light grey and is massive and blocky in outcrop. Outcrop is ≈ 15' long and 5' high. This argillite is sub phyllitic and bedding planes can still be seen in outcrop.

1. 332°, 89° SW 2" to 1.5'
2. 338°, 88° NE " " "
3. 75°, 53° SE Bedding 1" to 1.5'
4. 87°, 57° SE 1" to 1.5'
5. 330°, 77° SW 2" to 1.5'
6. 70°, 50° SE Bedding 1" to 1.5'

D80-73

Dark grey meta argillite displaying some green linearity breaks with a conchoidal fracture is glossy but sub phyllitic. Both quartz veins are stringers up to 4" thick can be seen in outcrop. The bedding is oriented at 95°, 36° NE. At this location several large open fractures can be seen.

1. A large open fracture ≈ 3" wide can be seen oriented at 100°, 43° SE where a part of the abutment is beginning to move away from the main mass and down toward the river ≈ along bedding.
2. Another large piece of the left abutment is moving down toward the NW and a 2' gap has opened up at 70°, 65° NW.

Joints

1. [illegible]
2. 32°, 60° E
3. 60°, 80° NW
4. 60°, 44° NW

100 yards west along the crest of the abutment. A land another open joint ≈ 6" wide and oriented at 300°, 74° N and another open fracture about 15 yds further west oriented at 300°, 84° N. The lithology itself continues to be meta argillite

D80-74

[illegible] grey meta argillite displaying some gross linearity. Numerous qtz stringers & veinlets - weathers to a light grey massive,

1. 17°, 63° E open approx 2' wide
2. 314°, 87° N - Open - approx 6' wide
3. 310°, 85° N. 6 53'
4. 294°, 84° S open ≈ 6" [illegible]

D80-75

Dark grey argillite with some greater linearity, numerous qtz stringers. Weathers to a light grey.

1. 235°, 80° SE All open fractures
2. 142°, 90° "
3. 135°, 90° "
4. 226°, 68° SE "

100 yds west of D80-75 there is [illegible] open joint in meta arg. oriented at. 208°, 82° W

D80-76 Dark grey meta argillite w/ qtz stringers and veinlets. Sub phyllitic by [illegible] glossy. Weathers light grey.

1. 75°, [illegible] SE open - 1" to 2"
2. 330°, 55° NE 2" to 1'
3. 205°, 85° S 1' to 3'
4. 90°, 53° SE 6" to 2' open
5. 275, 78° NW - looks like faulting

About 50 yds west of D80-76 and at the crest of the escarpment there is an outcrop of [illegible] rock which looks like a meta greywacke but does not appear to be [illegible] along strike. This is possibly a [illegible] which came off of the [illegible] and was quickly cooled before [illegible] could take place. It is also more highly fractured than the argillite.

D80-77 Dark grey meta argillite w/ some grain linearity. Quartz Stringers and veinlets. Weathers to light grey

Bedding at 45°, 78° SE
24°, 66 SE
172°, 76° E

D80-78

Dark grey almost phyllitic meta argillite w/ qtz stringers and veinlets. Weathers to a light grey

1. 354°, 75° NE	3" to 1.5'	I
2. 92°, 75° SE	3" to 1.5'	
3. 345°, 75° NE	3" to 1.5'	
4. 85° 70° SE	3" to 1.5'	II

8/27/80 Wednesday Devils Canyon Grid

D80-79

Dark grey meta argillite displaying some grain linearity. Qtz stringers and veinlets are evident. Weathers to a light grey. Bedding is oriented at 75°, 72° SE

Major Joints include
1. 335°, 80° NE
2. 333°, 80° NE

3. 75°, 67° SE

D80-80

Dark grey meta argillite displaying grain linearity but it is sub phyllitic. Qtz veinlets and stringers. Weathers to a light grey and is massive and blocky.

1. 305°, 80° N
2. 308°, 80° N — I
3. 38°, 60° SE — II

8/27/80 - Granodiorite Pluton South of Damsite at Devils Canyon

D80-81

Med grained microcrystalline pinkish grey biotite granodiorite. Weathers to a pinkish whitish grey. Massive and blocky. Also noted possible chlorite. CE = 0

1. 85°, 84° NW	2" to 3'
2. 85°, 88° NW	2" to 3'
3. 20°, 63° W	1' to 3'
4. 344°, 88° NE	1' to 3'

D80-82

Lt Grey w/pink tint, biotite, granodiorite, w/some possible [illegible] C.I. Medium grained mercrystalline. Weathers to whitish grey. Massive and blocky. Occassional xenoliths of dark grey meta argillite are found in the granodiorite at this station.

1. 5°, 67° SW 8" to 3'
2. 350°, 40° NE 1' to 3'
3. 354°, 90° " " "
4. 80°, 88° NW 8" to 5'

D80-83

Lt Grey med gr. mercrystaline biotite granodiorite. This granodiorite displays a subgneissic texture with parallelism of platy minerals and feldspars. C.I. ≈ 20, Qtz = [illegible]. Iron stained on some joint surfaces. Weathers to a grey white color.

1. 340, 80° NE 6" to 2'
2. 105°, 87° N 2" to 2'
3. 335, 80° NE 6" to 2'
4. 95°, 77° N 2" to 2'
5. 342, 90° [illegible]

D80-84

Light grey med gr. mercrystaline biotite granodiorite C.I. ≈ 20. Some subgneissic texture was noted in that feldspars and biotite is oriented in one direction. Weathers to a light pinkish grey. Massive and blocky.

1. 352°, 80° NE
2. 90°, 85° N
3. 352°, 84° NE
4. 84°, 88° NW
5. 340°, 82° NE

D. 80-85

Light grey med. grained mercrystaline biotite granodiorite C.I. ≈ 15, Qtz = 10%. No grain orienting at this site. Weathers to a light pink grey, massive and blocky.

1. 5°, 74° NE
2. 95°, 54° SE
3. 87°, 44° SE
4. 0°, 53° NE
5. 340°, 38° NE
6. 357°, 84° NE

D80-86

Pinkish grey - med grained mero-crystalline biotite granodiorite. Weathers to light pinkish grey. CI ≈ 18, PLZ ≈ 20%. Massive and blocky

1. 295°, 82°N 6" to 2.5'
2. 50°, 64°NW 1' to 2.5"
3. 310°, 75°NE 6" to 2.5'
4. 60°, 84°NW 1' to 2.5'
5. 315°, 84°NE 6' to 2.5'

D80-87

Pinkish grey - med grained mero crystalline biotite granodiorite - more decomposed than of - D80-86 - small outcrops ≈ 3' high 12' long. Weathers blocky & massive. CI ≈ 15, Quartz ≈ 20%.

1. 40°, 84°NW 4" to 1.5'
2. 90°, 74°NW 8" to 1.5'
3. 110°, 85°N 8" to 1.5'

D80-88

Contact between med. grained, light grey biotite granodiorite (mero crystalline, CI ≈ 18) and what must be a large xenolith of Dark grey meta argillite which is bleached and baked to a dusty buff color. The argillite is badly fractured but bedding appears to be at 95°, 20°S. The major joints in the granodiorite include.

1. 64°, 82°SE
2. 348, 64°NE
3. 64°, 84°SE
4. 346°, 66°SE
5. 66, 84°SE

8/27/80 [#5,51]

Duck Canyon — [illegible]
[illegible] of Cuk (15 [illegible])
[illegible] of the Rafter abutment.

D80+89.

Dark gray metavolcanic
with some dark [illegible]
[illegible] 15 [illegible]

[illegible]

Jeff [illegible]
[illegible] specimen with FeO2
[illegible] dark spots (sum)
[illegible] of [illegible]
[illegible] Brown [illegible]
[illegible] to yellow
[illegible]

1. 338°, 82° NE
2. 345, 16° NW
3. 353, 85 SE

D80 [illegible]

[illegible] metavolcanic [illegible]
[illegible] Weathers
[illegible]

1. 70, 64° SE 4 to 15'
2. 335, 37° S 1 to 15'
3. 53, 50° SE [illegible] 4 to 15'
4. 116, 56° N 1 to 2'
5. 345, 65° SW 2 to 1'

[illegible]
[illegible] 351, 26° NE
[illegible] 50' up the [illegible] the
[illegible] FeO2. The [illegible]
[illegible]
[illegible] stringers of
[illegible] FeO2 stain on joint
[illegible]

D 22

Dark green mica schist w/ some rain lineation but it's sub-phyllite. Fe stains on wall joints, surfaces. Quartz in light gray, black & medium-green in color. 10 inch 50 higher.

1. 344°, 74° SW 3" to 1.5"
2. 20°, 45° W 1" to 1"
3. 90°, 86° NW 2" to 1.5"
4. 350°, 90° 2" to 1.5"
5. 20°, 30° SW 4" to 1"

D 23 in Indian valley

D 23-95

Dark gray phyllitic mica schist with a single black mineral with darker gray. Fe2 [illegible] minerals and [illegible] inclined at 66°, 72° SE

1. 324°, 90° 3" to 1"
2. 243°, 85° SE 2" to 2"
3. 75°, 72° SE 2" to 1.5"
4. 95°, 70° SE 4" to 3"
5. 320°, 80° SW 3" to 1"
6. 320°, 85° SW 3" to 2"
7. 85°, 31° SE 4" to 3"

Approx. 10' above the level of the creek very siliceous aphanitic dike cuts across the schist at 350°, 90°. This material is very resistant to weathering and forms very large chunks. Appears represents a late stage silica rich injection into the zone of more intense amphibolite [illegible]. Blocks of this dike [illegible] a spectacular [illegible] [illegible] to [illegible] [illegible] [illegible]

8/[illegible]/80 - Reblocking of recovered stones along portage trail.

[#5, 58]

D 80-52 - Revisited

Plane of shear is oriented at 355°, 80° E. Slickenslides are dipping 55°–8° N and movement seems to be to the south (appears to be). The shear zone contains crushed and powdered argillite as well as large unaltered fragments.

DPD-85

Dark gray siltstone to mafic siltstone and fine gr. sandy siltstone. Outcrop is ≈ 80' long and up to 15' high. Mainly blocky and massive. A couple of minor shear zones at ≈ 47°, 63° NW. Major joints include

1. 65°, 68° SE
2. 65°, 44° NE
3. 100°, 63° SE

I also noticed [illegible] blocks of argillite as float along stream [illegible] weathered to a red [illegible] w/some

Q. Stamm

DPD-96

Dark gray to black metal siltstone to slate. Dipping at ≈ 40°, 54° NW. [illegible] [illegible] [illegible]

9/ /80 - [#5, 61] 59

Reconnaissance of area along Pittage creek - fault examination

D. 80-97

Dark grey glossy foliated meta sedimentary rock - phyllite. Weathers to a lighter grey green. Fairly heavily jointed.

1, 313, 74° NE 3" to 2.5'
2, 53, 77° SE

D. 80-98

At this outcrop I have observed what looks like an andesite with tiny laihlike microcrystalline phenocrysts of plagioclase and hornblend grey green in color with secondary pyrite. Weathers to a grey green color and is mod. well jointed. Also at this outcrop I observed what looks like a lapilli tuff. It is a dark grey resistant brown grey in color and appears to contain lapilli sized clasts

as well as tiny clasts of feldspar and hornblende which catch the sun and reflect it as tiny specs of light. Upon the surface of the rock it weathers to a mud dark grey and has FeOx stain on some joint surfaces.

D80-99-100

Glacial - in miles notes

D80-101

Dark grey to grey green fine grained meta sedimentary rock w/ clasts of black cherty looking material. This rock appears to be an intraformational conglomerate within the argillite clasts range in size from 1/4 to 3/8". A few tiny qtz eyes were also noted.

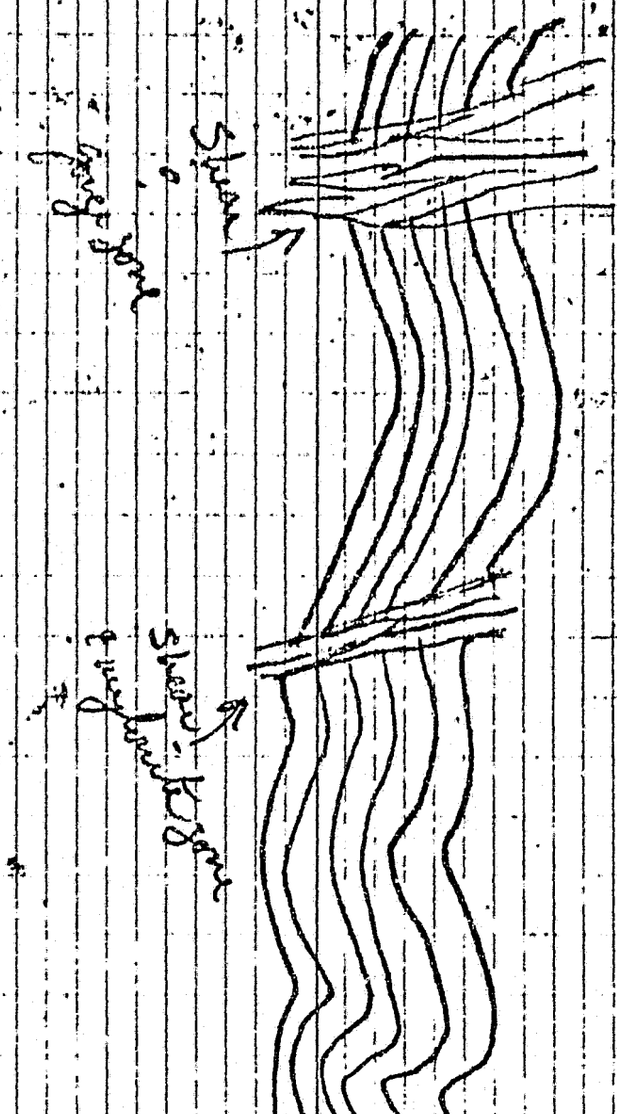
DSD-102

Orange brown soil composed of rare angular fragments of granodiorite in various stages of decomposition, feldspars are breaking down to clay minerals. Many of the large fragments have been crushed and veinlet with augmented sulphide mineralization ie. pyrite. No bedrock is exposed at this outcrop.

DSD-103

Dark gray meta argillite. At this location a shear passes through the meta argillite at 032°, 67° NW. There is a gouge zone of crushed mineralized meta argillite ≈ 10' wide and a zone of highly fractured meta argillite ≈ 20' wide. No good slickensided surfaces are evident. In places there is mylonite w/ sericite on slickensided surfaces 350°, 70° E. Bedding is oriented at 285°, 37° S. The fractured and badly disturbed zone

encompasses the entire outcrop ≈ 200' X 100'. Shear orientation 7, 75° E.



9/5/80 - Devils Canyon
Reconnaissance traverse along right abutment. [#5, 67]

D 80-104
Dark grey meta argillite displaying some grain linearity weathers to a light grey w/ FeO_2 stain on some joint surfaces. Bedding appears to be oriented at 80°, 44° SE

Joints 1. 20°, 77° W
2. 22°, 90°
3. 18°, 60° E

Elevation 1,642' at 12:00 Noon

D80 105 Also observed pyrite mineralization and in places a phyllitic or sub phyllitic texture is observed.

1. 330°, 77° SW 3" to 4'
2. 60°, 58° SE 3" to 1.5' Bedding
3. 5°, 87° SE 3" to 1'
4. 330°, 84° NE 3" to 4'
5. 75°, 45° SE 3" to 1.5' Bedding

Qtz veins and qtz stringers running through this outcrop.

D80-106
Dark grey phyllitic meta argillite w/ secondary pyrite mineralization. Iron stain on some joint surfaces possible manganese dendrites. Yellow sulphur stain is also visible on some joint surfaces.

1. 337°, 84° NE 3" to 1.5'
2. 70°, 58° SE 2" to 2' Bedding
3. 14°, 72° SW 2" to 1.5'
4. 350°, 68° SW 3" to 1.5'
5. 55°, 62° SE 2" to 2' Bedding
6. 340 85° NE 3" to 1.5

1480' Elevation at 1:15

D80-107
Dark grey phyllite w/ secondary pyrite, irregular & blocky fracture, FeO_2 stain on some joint surfaces. Weathers to a light grey. Massive and blocky. Bedding appears to be oriented at 55°, 55° SE.
Joint orientations include
1. 0°, 44° SW
2. 338°, 82° NE
3. 325°, 50° SW
4. 25°, 80° E

Elevation 1495' at 1:45 PM

D80-108

Dolora grey vuta argillite displaying some grain linearity. Sub phyllitic w/ veins & stringers of quartz. Irregular to blocky fracture. FeO_2 Stain on some joint surfaces. Weathers to a light grey.

1. 342°, 84° NE ≈ 2" to 1.5'
2. 350°, 80° NE ≈ 2" to 1.5'
3. 310°, 27° S ≈ 2" to 1.5'
4. 43°, 83° SE ≈ 2" to 1.5'
5. 315°, 89° S ≈ 2" to 1.5'

Elevation 1725' at 2:30 PM

D80-109

White to pink white felsic dike w/ quartz eyes and alkalik feldspar. This rock appears to be the product of a late stage siliceous liquor moving off of the cooling granodiorite pluton and invading a cooler argillite host rock. This emanating liquid was quenched or very rapidly cooled preventing it from developing a granular texture. It is also

highly fractured and iron stained. Oriented at 110°, 74° N to 330° 74° NE

Major Joints at

1. 310°, 22° SW .25" to 3"
2. 100°, 88° N .25" to 3"

Very highly fractured and difficult to obtain a major joint orientation. I observed a highly oxidized zone of approx the same dimensions as the one on the right abutment over on the left abutment, or ≈ 10' thick and of indeterminate height.

9/6/80 - Saturday

Reconnaissance geology of area to the east of Dubois canyon dam site.

D80-109' 4-3-16

White pink biotite granodiorite med. grained merocrystalline. CI ≈ 15. Weathers to a pinkish yellow. Massive and blocky. Trace of iron stain on weathered surfaces. Observed a xzeno lith of grey green meta argillite partly assimilated at contact edges by the granodiorite.

Major joint orientations include parallel joints at 1. 310°, 79° N 2" to 2'

2. 310°, 85° N	2" to 2'
3. 34°, 75° W	2" to 1.5'
4. 37°, 43° W	2" to 1.5'
5. 85°, 87° NW	2" to 2'
6. 110°, 40° N	3" to 1.5'
7. 64°, 82° NW	4" to 2'

Elevation 2,518'

D80-109 Continued 4-3-16

White to pink biotite granodiorite med grained merocrystalline. CI ≈ 18. Weathers to a pinkish yellow grey. Massive to blocky. Trace of FeO_2 stain on some joint surfaces.

1. 10°, 84° NE	1" to 2.5'
2. 105°, 80° N	2" to 2'
3. 112°, 82° S	2" to 2'
4. 120°, 83° N	1" to 2'
5. 335°, 80 NE	1" to 2'
7. 308°, 90°	4" to 2'

D80-110 D-5

Dark grey phyllite w/ small amount of FeO_2 stain on some joint surfaces. Weathers to a med grey w/ well developed slaty cleavage. Bedding appears to be in the same plane as foliation and is oriented at 57°, 67° SE

1. 318° 77° N	3" to 1.5'
2. 65°, 63° SE	2" to 1'
3. 310°, 82° N	3" to 1.5'
4. 0°, 84° SW	3" to 1.5'
5. 128°, 86° N Parallel joints (very obvious)	3" to 1.5'
6. 50°, 64° SE	2" to 1.5'
7. 300°, 72° N	2" to 15'

Elevation 3140'

D80-115

Medgrained mesocrystalline hornblende, biotite diorite. C.I. = 30. Lots of epidote as a secondary alteration mineral. Alters to a yellow white green. Small amount of FeO_2 stain on some joint surfaces

D80-116

Dark to med grey porphyritic andesite w/ phenocrysts of plagioclase and hornblende, w/ secondary pyrite. Weathers to a grey green w/ heavy iron stain on joint surfaces. Fairly heavily jointed.

1. 337°, 85° NE 1" to 6"
2. 75°, 64° SE ½" to 6"
3. 300°, 84° N 1" to 6"
4. 325°, 33° S 1" to 4"

D80-117 4-5-16

Dark grey aphanitic rock which at first looks like a meta argillite land (I'm not entirely certain it isn't) but which upon closer observation reveals a porphyritic texture w/ phenocrysts of hornblende and feldspars. There is very little FeO_2 stain on the weathered or jointed surfaces but some surfaces show a pockmarked surface where feldspar minerals have leached out. This rock weathers to a medium grey w/ greenish cast and may in fact be a recrystallized argillite. Hand specimen

1. 47°, 86° SE 2" to 1.5'
2. 320°, 88° SW 2" to 1.5'
3. 46°, 87° SE 2" to 1.5'
4. 325°, 90° 2" to 1.5'

Elevation 3,312'

[illegible] Med grained grey pink white biotite granodiorite, microcrystalline CI ≈ 18 weathers to a pinkish yellow. Massive and blocky.

1. 90°, 90° ≈ 2" to 1'
2. 330°, 77° NE ≈ 2" to 1'
3. 60°, 90° " " "
4. 15°, 55° SW " " "

Elevation 2,019'

9/11

Reconnaissance Geology of area east of Devils Canyon

D80-119 4-5-16

Med. grained biotite granodiorite C.I. ≈ 15. Qtz. = 20%. Light greenish grayish white in color. Weathers to a pinkish yellow and is massive and blocky. Outcrop is 20' long and 4' high.

1. 340°, 78° NE 2" to 8"
2. 83°, 84° SE 2" to 1.5'
3. 335°, 78° NE 2" to 8"
4. 40°, 55° NW 2" to 1'

Elevation 2200' at 8:45 AM

D80-120

Dark grey phyllite w/ iron stain on the fracture surfaces. Qtz stringers and veinlets, as well as secondary pyrite weathers to a medium grey. Blocky & massive.

1. 320°, 80° SW 1" to 2"
2. 300°, 62° N " " "
3. 45°, 55° E " " "
4. 50°, 55° E (Outlying) " "

Elevation 3200' at 9:15 AM

D80-121 4-5-16

Grey green biotite hornblende diorite. C.I. ≈ 35. Weathers to a medium grey color. Some iron stain on joint surfaces, massive and blocky.

1. 83°, 81° NW 4" to 1.5'
2. 29°, 86° N 2" to 1'
3. 355°, 63° SW 2" to 1'
4. 60°, 75° NW 4" to 1.5'

Elevation 2600' at 10:00 AM

D80-122

Dark grey phyllite w/ qtz. stringers and veinlets, iron stain on joint surfaces. Secondary pyrite. Weathers to a medium grey blocky and massive.

1. 30°, 90° 1" to 1.5'
2. 105°, 84° N 2" to 1'
3. 20°, 89° N 1" to 2.5'
4. 10°, 34° NE 2" to 1'

Elevation 3750 at 10:25 AM

D80

Med. grained mesocrystalline biotite granodiorite. Pinkish light grey. C.I. 15. Qtz ≈ 20%. Weathers to a pink grey. Massive and blocky.

1. 305°, 87° S 1" to 1.5'
2. 20°, 54° W 1" to 1'
3. 15°, 72° NE 1" to 1.5'
4. 90°, 78° SE 1" to 1.5'
4. 5°, 55° SW 2" to 1.5'

D80-124

Pinkish light grey biotite granodiorite. C.I. ≈ 15. Qtz. ≈ 20%. Med. gr. mesocrystalline. Weathers to a light grey and is massive and blocky.

1. 10°, 80° SW 1" to 1.5'
2. 77°, 80° SE " " "
3. 20°, 63° W " " "
4. 345° 90° " " "

Elevation 2150' at 12:10 PM

D80-125 4-3-14

Dark maroon grey subphyllitic metaargillite w/ veins & stringers of qtz. and cut by numerous dikes of pinkish white felsic material, fine grained w/ qtz eyes. Probably a quickly cooled emanation from the granodiorite pluton.

1. 330°, 88° NE 2" to 1'
2. 345°, 68° SW 2" to 1'
3. 32°, 64° E 1" to 1.5'
4. 325°, 78° NE 2" to 1'
5. 335°, 68° SW 2" to 1'
6. 13°, 88° NW 1" to 1.5'
7. 95°, 22° NW 2" to 1.5'

D80-126

Glacial outwash - matrix material is a silty sand w/ a light trace of clay. Small ⊥ stratum. Mostly gravel size grains w/ some cobbles. Outcrop is 50' long and 20' high.

Elevation is 2546' at 2:30 PM

D80-127

Pinkish light grey med gr. mero-crystalline biotite granodiorite C.I. ≈ 15. Weathers to a yellow grey. Trace of iron stain on some joint surfaces. Weathers massive and blocky.

1. 7°, 84° NE 1" to 1.5'
2. 98°, 54° SE 1" to 2'
3. 350°, 85° NE 1" to 1.5'
4. 60°, 65° NW 1" to 1.5'

Elevation is 2,450' at 3:05 PM

D80-128

Medium grey meta argillite w/ qtz stringers & veinlets. Appears to be baked and cross cut by numerous felsic dikes of fine gr. material light in color w/ qtz eyes.

1. 75°, 36° NW 1" to 8"
2. 340°, 85° SW 1" to 1.5'
3. 80°, 35° NW 1" to 8"
4. 320°, 80° SW 1" to 1.5'

Elevation 3400' at 3:40 PM

D80-129 4-3-14

Dark grey meta argillite w/ some grain linearity. Small amt of sulphide mineralization. Iron stains on some joint surfaces. Weathers to a light medium grey.

1. 78°, 78° SE Bedding 1" to 8"
2. 75°, 54° NW 1" to 1'
3. 15°, 78° W 2" to 1'
4. 20°, 80° W 2" to 1'

Elevation 2815' at 4:50 PM

D80-130

Light yellow grey med gr. mero-crystalline biotite granodiorite. Some alteration of feldspars to epidote. Weathers light grey, blocky and massive. Iron stains on some joint surfaces.

1. 350°, 67° NE 1" to 1.5'
2. 357°, 65° NE 1" to 1.5'
3. 100°, 55° SE 1" to 8"
4. 340°, 76° NE 1" to 1.5'

Elevation 1820' at 5:15 PM

9/1[illegible]/80 – Roon. along Susitna River (81)
up[illegible] from Devils Canyon.

D80-131

Med. grained, grey white, mercrystaline, biotite granodiorite C.I. ≈ 18. Weathers to a dark silver grey, massive and blocky. Qtz. ≈ 15%. Outcrop is ≈ 200' long along river and from 5' to 15' high.

1. 315°, 75° SW ≈ 2" to 1'
2. 298°, 72° S " to 1'
3. 18°, 82° SW " " "
4. 283°, 65° S " " "
5. 23°, 70° E " " "
6. 335°, 27° NE " " "
7. 293°, 53° N " " "
8. 43°, 83° E " " "
9. 80°, 82° SE " " "
10. 335°, 84° NE " " "
11. 304°, 16° N " " "

D80-132

Greywhite mercrystaline, biotite granodiorite. C.I. ≈ 18. Qtz ≈ 15 to 20%. Weathers to a med. grey - blocky & massive. Identified some chlorite clusters at this location in hand specimen. Outcrop is small island ≈ 200' x 300' ≈ 2" to 1'

1. 94°, 84° NW " "
2. 350°, 62° SW " "
3. 340°, 54° SW " "
4. 48°, 82° SE " "
5. 355°, 65° NE " "
6. 73°, 80° NW " "
7. 34°, 87° NW " "
8. 350°, 75° NE " "
9. 345°, 20° SE " "
10. 90°, 22° SE " "

9/[illegible]/80

Reconnaisance Geology of area East of high lake and Devil Creek. Weather is good - scattered clouds.

D80-133 4-3-18

Offshore to pinkish grey med. grained microcrystalline biotite granodiorite. C.I. ≈ 15, Qtz ≈ [illegible]%, Weathers to a med to light grey - blocky and massive

1. 53°, 82° NW 2" to 3'
2. 307°, 86° S 3" to 3'
3. 60°, 82° NW 2" to 3'
4. 309°, 88° S 3" to 3'
5. 52°, 86° NW 2" to 3'

D80-134 4-3-18

Dark grey phyllitic meta argillite. Some FeO_2 stain on joint surfaces. Weathers to a medium grey. Fairly blocky and massive. It appears that bedding and foliation lie along the same orientation at 18°, 52° E

Joint Orientations include

1. 307°, 64° SW <1" to 4"
2. 73°, 67° SE " " "
3. 76°, 52° NW " " "
4. 317°, 75° NE " " "
5. 294°, 75° NW " " "

D80-135 4-3-18

light grey, medium grained, microcrystalline biotite granodiorite

C.I. ≈ 19, Qtz ≈ 21%. Weathers to a buff grey. Blocky and massive. Outcrop is 30' long and 7' high.

1. 312°, 87° NE 3" to 3'
2. 7°, 85° SW 2" to 3'
3. 92°, 36° SE 2" to 3'
4. 350°, 70° SW " " "
5. 297°, 68° S " " "
6. 30°, 32° W " " "

D80-136 4-4-18

Light gray to off white aphanitic rock w/ a few small xenoliths of what appears to be argillite. This rock is highly siliceous and bucks w/ an inequigranular to a cinchoidal fracture. Arsenopyrite as sulphide mineral is disseminated throughout. Heavy iron stain on joint surfaces. Heavily jointed. Appears to be a quickly cooled late stage siliceous emanation from within the granodiorite pluton. Outcrop is 20' x 10'

1. 0°, 85° NE	<1" to 8"
2. 282°, 77° SE	<1" to 6"
3. 6°, 78° NE	<1" to 6"
4. 316°, 86° N	<1" to 6"
5. 288°, 4° N	<1" to 6"
6. 2°, 84° NE	<1" to 8"

Exposed ≈ 300' further along the bluff toward the east and ≈ 50' above the last outcrop is a large outcrop of dk gray phyllite ≈ 200' long and 30' high. It is D80-137.

D80-137 4-4-18.

Dark gray phyllite w/ qtz stringers and some

FeO2 stain on the joint surfaces. Weathers to a medium gray and is fairly well jointed. Bedding is obscured & it is not possible to obtain bedding orientation.

1. 300°, 72° N	1" to 10"
2. 18°, 82° W	1" to 10"
3. 93°, 60° NW	1" to 10"
4. 0°, 81° SW	1" to 8"
5. 95°, 59° SE	1" to 10"
6. 333°, 84° SW	1" to 10"

D80-138 4-4-18

Light gray medium grained microcrystalline biotite granodiorite in contact with an aphanitic highly siliceous rock w/ qtz eyes and zonite mineralization. The granodiorite weathers tan & is massive and is rarely iron stained. The dike rock is highly jointed and deeply iron stained. Joints taken on dike.

1. 24°, 72° W	= 1" to 8"
2. 350°, 90°	"
3. 285°, 82° N	"
4. 358°, 87° NE	"
5. 287°, 84° NW	"
6. 100°, 82° NW	"

Also outcropping here is a dark gray sub phyllitic meta argillite cross cut and intruded by biotite granodiorite, not possible to obtain bedding orientation.

D80 - 4-4-18

Dark grey — phyllite-meta argillite. Heavily iron stained on joint surfaces. Weathers to a mottled orange, brown. Fairly well jointed. Not possible to determine bedding at this outcrop.

1. 25°, 90° <1" to 3"
2. 40°, 67° SE <1" to 3'
3. 98°, 47° NW <1" " 3'
4. 350°, 87° NE <1" " 3'
5. 100°, 58° NW <1" " 3'
6. 47°, 60° SE <1" " 3"

w/ qtz veins and veinlets.

D80-140 - 4-3-20

Dark grey green phyllite, w/ occasional quartz stringers. FeO_2 stain on some joint surfaces. Weathers to a dark to medium grey w/ sulphur and FeO_2 stain on some weathered surfaces. Bedding appears to lie in the plane of foliation which is oriented at 82°, 49° SE.

1. 340°, 77° NE 6" to 3'
2. 73°, 53° SE <1" to 1'
3. 334°, 82° NE 2" to 3'
4. 72°, 32° NW 6" to 2'
5. 24°, 42° NW 6" to 2'

D80-141 4-3-20

Dark grey phyllite w/ small amt of FeO_2 stain on some joint surfaces weathers to a medium grey and is massive and blocky, occasional qtz. stringers.

1. 300°, 84° N 2" to 8"
2. 328°, 16° NE 2" to 8"
3. 40°, 85° E <1" to 6" Bedding Plane
4. 303°, 88° N 2" to 8"
5. 312°, 14° NE 2" to 8"

[illegible]

type [illegible] One is [illegible] the [illegible]

[illegible]

w/ [illegible]

of [illegible] The [illegible]

[illegible] jointed

[illegible]

[illegible] 86° NW

9/12/80 - Friday

Reconnaissance Geology of area east of Devil Creek.

DSO-142 4-3-20

Med. grained, grey green, mesocrystalline biotite diorite C.P. 30. Iron stain on some joint surfaces. Weathers to a medium grey, blocky and massive. Noted the presence of large xenoliths of argillite in this diorite.

1. 335°, 83° NE 8" to 3'
2. 58°, 48° NW 6" to 2'
3. 328°, 77° NE 8" to 3'
4. 12°, 90° 6" to 2'
5. 342°, 60° SW 6" to 2'
6. 327°, 78° NE 5" to 2'

DSO-143 4-3-20

This outcrop consists of two rock types. One is a phyllitic schist the other is a biotite diorite to qtz diorite.

1 Dark-grey phyllite to schistose rock w/ rudimentary [illegible] of biotite and quartz. This rock is

moderately but not heavily jointed and the plane of foliation and possibly bedding lies at 283°, 86° NW. FeO2 stain in weathered surfaces.

1. 55°, 76° SE 1" to 6"
2. 120°, 73° N 1" to 1.5'
3. 350°, 87° NE 3" to 1.5'

2. Med. grained grey biotite qtz diorite mesocrystalline w/ some FeO2 stain. This rock type intrudes and abuts the schist at several places along this outcrop. The rock type weathers to a med. grey and is massive and blocky.

1. 305°, 87° S 8" to 3'
2. 40°, 77° SE 3" to 2'
3. 333°, 90° 8" to 3'
4. 12°, 15° W 3" to 2'

D8D-144 4-3-21

Dark grey green meta argillite w/ some well developed grain lineation. FeO_2 stains on some joint surfaces. Weathers to a red grey and is moderately well jointed. Bedding is orientated at 13°, 50° NE.

1. 300°, 75° S 1" to 1'
2. 335°, 48° SW <1" to 1.5'
3. 20°, 50° E <1" to 1'
4. 327°, 60° SW <1" to 1.5'
5. 60°, 72° SE 1" to 1'

D8D-145 4-3-23

Dark grey phyllitic to schistose rock w/ sedimentation [illegible] of biotite and quartz. Weathers to a med grey. W/ iron stain on some surfaces. Moderately well jointed. Bedding lies at ~ 28°, 58° SW

1. 27°, 58° SW <1" to 1'
2. 300°, 84° N 6" to 3'
3. 336, 36° SW 8" to 3'

4. 290°, 79° N 6" to 3'
5. 10°, 25° SW 8" to 3'
6. 37°, 60° W <1" to 1'

Outcrop is 300' long 12' high.

[illegible]	[illegible]	33°, 75° NW	[illegible]
5°, 34° E	[illegible]	298°, 72° N	[illegible]
309°, 77° NE	[illegible]	350°, [illegible]	[illegible]

D8D-146 4-3-23

Light grey med. grained biotite qtz diorite to granodiorite. C.I. ≈ 25. Displays some [illegible] compositional banding. Weathers to a pink grey. Massive and blocky.

1. 303°, [illegible] 8" to 3'
2. 5°, 34° E 6" to 2'
3. 309°, 77° NE 8" to 3'
4. 33°, 75° NW 6" to 2'
5. 298°, 72° N 6" to 2'
6. 350°, 40° SW 8" to 3'

* Also located an outcrop of grey green well baked meta argillite ≈ 3' high 7' long.

D80-141 4-3-23

[illegible] greenish [illegible] biotite chlorite diorite. Green [illegible] due to breakdown or epidotization of [illegible]. C.I. ≈ 25. Weathers to a medium grey color. Moderately well jointed. Outcrop is 20' long and 4' high.

1. [illegible]0°, 54° NW 5" to 1.5'
2. 75°, 57° SE " "
3. 325°, 67° NE " " "
4. 21°, 27° SE " "
5. 294°, 57° N " "

D80-148. 4-4-21

Outcrops are on a hill most of which is a med gr. grey biotite diorite C.I. ≈ 30. Weathers to a light grey, small out of FeO_2 stain on weathered surfaces. Massive and blocky. Also on this hill are outcrops of dark grey sub phyllitic meta argillite. Weathers massive and blocky. Little FeO_2 stain. Not possible to obtain a bedding orientation.

1. 325°, 88° SW <1" to 15'
2. 60°, 88° NW " " "

3. 327°, 90° <1" to 1.5'
4. 58°, 88° NW " " "

9/16/80 Tuesday

Reconnaissance Geology of area between Devil Creek and Tsusena Creek

D80-149 4-5-24 D4

Dark grey qtz rich meta argillite. Numerous qtz veins and stringers. Some grain linearity is displayed. Fracture is irregular. Weathers to a medium grey. Small amt. of iron stain on some joint surfaces. Massive and blocky. Not possible to determine bedding.

1.	300°, 78° N	2" to 2'
2.	40°, 45° SE	2" to 1.5'
3.	25°, 86° W	2" to 2'
4.	306°, 66° NE	2" to 2'
5.	14°, 63° SW	2" to 1.5'
6.	321°, 36° NE	2" to 2'

Elevation 2430' at 9:35 AM

D80-150 45-24-D4

At this outcrop there is a light grey aphanitic rock w/ phenocrysts of orthoclase, pelic plagioclase, and hornblende, as well as some small qtz eyes. Compositionally and texturally I would call this rock a rhyodacite but it is most likely a quickly cooled mass of granodiorite. There is an outcrop of meta argillite ± 10' away across a small gully from this rock type. It weathers to a light green grey w/ slight FeO_2 stain. Massive and blocky.

1.	50°, 78° NW	4" to 2.5'
2.	311°, 90°	4" to 2'
3.	46°, 77° NW	4" to 2'
4.	340°, 77° NE	4" to 2.5'
5.	227°, 69° NE	6" to 2.5'
6.	320°, 78° NE	4" to 2.5'

Hand specimen taken

D[illegible]151 4-5-24

Dark grey coarse grained biotite diorite compound of interlocking masses of biotite and plagioclase crystals. The plagioclase crystals are for the most part round or elliptical in slopes. This rock weathers to a yellow grey, and is massive and blocky.

1. 338°, 74° SW 3" to 2.5'
2. 47°, 87° SE 3" to 1.5'
3. 283°, 87° SE 3" to 1.5'
4. 338°, 65° NE 3" to 3'
5. 50°, 67° NW 3" to 2'
6. 326, 81 SW 3" to 2.5'

Elevation 1830' at 10:05 AM

D80-152 4-5-24

Dark grey phyllitic meta argillite. Fracture is irregular and blocky. Some FeO_2 on some joint planes. Weathers to a medium grey, massive and blocky.

1. 300°, 88° S Bedding - 1" to 3'
2. 0°, 69° NE 3" to 1.5'
3. 33°, 4° SE 2" to 1.5'

4. 337°, 63° SW 2" to 1.5'
5. 285°, 90° 2" to 1.5'
6. 345°, 72° SW 1" to 3'

This phyllite is cut by numerous veinlets and stringers of quartz.

Elevation is ≈ 2000' at 10:40 AM

D80-153 4-5-23

Pinkish grey med grained biotite granodiorite C.I. ≈ 25. Weathers to a yellow grey. Massive and blocky. Microcrystalline.

1. 338°, 82° SW 3" to 2'
2. 284°, 64° N 3" to 2'
3. 54°, 69° W <1" to 2'
4. 342°, 88° SW 3" to 2'

Elevation 2,230' at 11:10 AM

D80-154 4-5-21

tan to pink med grained merocrystalline granite. C.I. ≈ 5. Weathers to a tan or buff color. Highly fractured. Outcrops is ≈ 30' long and 20' high.

1.	102°, 77° SE	1" to 3"
2.	45°, 54° SE	1" to 6"
3.	23°, 27° NW	1" to 6"
4.	310°, 66° N	1" to 3"
5.	94°, 73° SE	1" to 3"

Elevation is ≈ 1,950' at

D80-155 4-5-21

Pink grey meta argillite displaying some grain linearity. Qtz rich w stringers and veinlets of quartz as well as larger qtz veins. Weathers to a medium grey moderate to highly fractured. Bedding appears to be oriented at 45°, 76° SE

1.	95°, 78° NW	<1" to 8'
2.	5°, 21° NE	<1" to 8"
3.	88°, 60° NW	<1" to 8"
4.	40°, 83° SE	<1" to 8"
5.	318°, 87° NE	<1" to 8"

D80-156 4-5-21

Pink grey biotite granodiorite merocrystalline C.I. ≈ 25. Weathers to a med orange grey. Small ant. of iron stain on some joint surfaces. Weathers blocky moderately well fractured & jointed.

1.	352°, 87° SW	<1" to 6"
2.	314°, 87° SW	<1" to 6"
3.	108°, 87° NW	<1" to 8"
4.	14°, 82° NE	<1" to 8"
5.	340°, 33° SW	<1" to 1'
6.	90°, 47° SE	<1" to 8"

Elevation ≈ 2500' at 3:30 PM

D80-157 -

Biotite feldspar schist. Bended yellow orange and black. Weathers to a medium grey is blocky and develops pointing along the plane of schistocity. Plane of foliation is at 62°, 68° SE

1.	340°, 68° NE	3" to 5'
2.	350°, 86° SW	2" to 5'
3.	77°, 84° NW	<1" to 2'

D80-158

Light grey med. grained biotite granodiorite to diorite - CI ≈ 27 microcrystalline. Weathers to a red, yellow grey. Massive and blocky.

1. 330°, 73° NE 8" to 3'
2. 55°, 60° NW 1" to 3'
3. 62°, 62° NW 8" to 3'
4. 40°, 52° SE 8" to 3'

Elevation 4550' at 4:50 PM

≈ 3740' 305, 88°S 20, 77 SW 14, 18 SW 305, 47° NE

D80-159

Grey med. grained microcrystalline hornblende biotite diorite. Weathers to a mud grey, massive and blocky.

1. 305°, 88° S 4" to 2'
2. 308°, 85° S 4" to 2'
3. 305°, 47° NE 8" to 2'
4. 14°, 18° SW 8" to 2'
5. 20°, 77° SW 8" to 2'
6. 20°, 80° SW 8" to 2'

Elevation is ≈ 3740' at 5:15 PM

9/17/80

Reconnasance of Area West of Tsusena Creek

D80-160 D-4

Dark red to red grey poorly sorted immature sand grains range in size from fine gr to coarse gr. and are composed of qtz, shale, slate, feldspar, biotite, chlorite. Sub angular to angular w ferruginous looking cementing material. Weathers to a medium grey. For the most part it is poorly indurated but not heavily fractured. This material is Prob. lithified glacial Outwash.

1. 0°, 88° SW 2' to 15'
2. 90°, 63° NW 2' to 15'
3. 95°, 22° SE 2" to 4' possibly holding or close to it

Elevation 1820 at 9:00 AM

D80-161 4-5-24

Med grained yellow grey mesocrystalline biotite granodiorite to diorite CI x 30. Weathers to a light yellow grey mod. well fractured and jointed.

1. 310°, 56° N 1' to 2.0'
2. 28°, 90° 4" to 2.0'
3. 66°, 33° SE 8" to 1.5'
4. 58°, 57° NW 8" to 1.5'
5. 304°, 38° N 1' to 2.0'

Elevation at 9:35 AM is 2,060'

D80-162 4-5-21

Tannish grey med. grained mesocrystalline biotite granodiorite CI = 17, Qz = 20%. Weathers to a silver tannish grey. moderately well jointed. Some FeO_2 stain on joint surfaces.

1. 308°, 90° 2" to 1'
2. 46°, 87 NW 2" to 1.5'
3. 302°, 76° NE 2" to 1'
4. 309°, 48° N 2" to 1'
5. 62°, 80° NW 2" to 1'

D80-[illegible] 14-3-16

Dark grey meta argillite displaying [illegible] linearity. Qtz veinlets and stringers are evident. Weathers to a medium grey. Small amount of pyrite as a secondary mineral.

Joint orientations include

1. 60°, 70° SE 3" to 1.5'
2. 14°, 65° SW " " "
3. 25°, 50° W " " "
4. 15°, 70° W " " "

Glacial striations at
1. 310°
2. 290°

Elevation 2,453' 4-3-16

D80-112

Med gr. mesocrystalline - biotite granodiorite, C.I. ≈ 15. Pinkish grey in color. Weathers to a yellowish [illegible]. Massive and blocky.

Parallel joints at 290°, 86° NE

1. 25°, 90° 8" to 4'
2. 110°, 85° N 8" to 4'

Elevation 2,620'

D80-[illegible] 4-3-16

Dark grey phyllite w/qtz veinlets and stringers. Weathers to a med. grey. Small amount of iron stain on some joint surfaces. Bedding has at 74°, 89° SE

1. 340°, 83° SW 2" to 1'
2. 77°, [illegible] SE 1" to 1'
3. 337°, 80° SW 2" to 1'

D80-114 4-3-16

Greyhites/greenish spots - biotite granodiorite, C.I. ≈ 18. Weathers to a off yellow color. Massive and blocky. Small amount of iron stain on some joint surfaces.

1. 333°, 86° SW 2" to 2'
2. 44°, 65° SE 3" to 1.5'
3. 335°, 86° SW 2" to 2'
4. 30°, 55° SE 3" to 1.5'

Elevation 2,630'

* At this time it appears that the contact between Kag and Tbgd extends NE from between this station and D80-111 and continues through the low areas and small lakes W and SW of high lake and then continues NE toward devil creek.

D80-163 4-4-19

Light grey, medium grained biotite granodiorite mesocrystalline. Weathers to a yellow grey. Slight amount of iron stain on some joint surfaces. CI ≈ 17, Q ≈ 2% ≈ 15%. Moderately well jointed:

1.	90°, 73° SE	3" to 2'
2.	78°, 35° NW	3" to 1.5'
3.	14°, 87° SW	2" to 1.0'
4.	335°, 30° NE	3" to 1.5'
5.	90°, 82° NW	2" to 2'

Elevation at 10:45 AM

D80-164 4-4-19

Dark grey phyllite w FeO_2 stain on some joint surfaces. Small almandine garnets throughout this rock. Weathers to a medium grey w/ occasional qtz stringers and veinlets. Moderately well fractured. Bedding is possibly merited at 40°, 87° SE.

1.	337°, 75° NE	2" to 1.5'
2.	10°, 77° NE	1" to 1'
3.	70°, 75° SE	1" to 1.5'
4.	322°, 74° NE	2" to 1.5'

Elevation at 11:15 AM is

D80-165 4-4-21

Med grained, light grey biotite diorite. Weathers to a yellow grey. Small amt. of FeO_2 stain on some joint surfaces. Moderately well jointed - blocky & massive

1.	52°, 43° SE	2" to 1'
2.	25°, 84° E	3" to 8"
3.	352°, 81° SW	2" to 1'
4.	318°, 73° SW	2" to 1'
5.	315°, 85° SW	2" to 1'

Elevation at 12:00 is 3,700'

D80-166 4-4-24

Med. to dark grey phyllite to schist. FeO_2 stain on some joint surfaces. Weathers to a med. grey. Plane of foliation is oriented at ≈ 20°, 52°W.

1. 5°, 50° NE 2" to 1.5'
2. 304°, 86° S 2" to 1'
3. 25°, 73° W <1" to 8"

Moderately heavily Jointed

Elevation at 1:00 PM is 3,140'

D80-167 4-5-24 - D4

At this location two rock types occur.

1. Dark grey phyllite to schistose rock weathers to a medium grey, FeO_2 stain on some joint surfaces, this rock rock type has been intruded by and almost entirely replaced by a medium grained mesocrystalline light grey biotite granodiorite which weathers to a light grey and is

moderately well jointed

1. 103°, 70° NW
2. 0°, 82° NE
3. 80°, 86° NW
4. 330°, 89° NE

Elevation is 3,980' at 1:20 PM

D80-168 - 4-5-26 - D4 (4-4-26)

Pink grey med. grained mesocrystalline biotite granodiorite. Weathers to a med pinkish grey to yellow grey. Tr. FeO_2 stain on some joint surfaces. Moderately well jointed.

1. 17°, 64° SW 2" to 10"
2. 92°, 84° NW 1" to 8"
3. 0°, 55° SW 2" to 10"
4. 100°, 87° NW 1" to 8"
5. 320°, 18° NE 2" to 10"

Elevation 3,620' at 2:00 PM

D[illegible]

Light grey fine to medium grained [illegible] biotite granodiorite. Weathers [illegible] greyish grey. Trace FeO_2 stain on [illegible] weathered surfaces. Moderately well jointed

1. 3[illegible]5°, 45° SW	2" to 1'
2. 5[illegible]°, 38° SE	1" to 8"
3. 90°, 46° SE	2" to 10"
4. 8[illegible]°, 37° SE	1' to 8"
5. 95°, 77° NW	2" to 1'

Elevation at 3:45 PM is 3,960'

D[illegible] 170

Grey med grained merocrystaline biotite, hornblende diorite. CI = 38%. Weathers to a greenish grey and is massive and blocky. Slightly jointed

1. 97°, 64° NW	1' to 4'
2. 20°, 84° E	1' to [illegible]'
3. 110°, 51° SE	1' to 4'
4. 14°, 74° SW	1' to 3'

Elevation at 3:45 PM is 2,670'

D[illegible] 171

Med grained yellow grey biotite granodiorite. CI ≈ 34. Weathers to an orange grey color. FeO_2 stain on most joint surfaces, badly decomposed in places, and fairly well jointed

1. 73°, 66° NW	1" to 8"
2. 330°, 80° SW	1" to 6"
3. 8°, 78° SW	1" to 8"
4. 30°, 90°	1" to 8"

Elevation at 4:00 PM is 2,580'

111

1/19/80 - Friday
Devil Canyon - Correction of site
[illegible]
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Photo MOSAIC
WATANA 85
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8-18-80
[4, 1]

It's cloudy out today with low clouds. Will begin working in Devil Canyon today. Plan on air reconnaissance and stopping at the drill rig

Watana
2262' @ 58' @ 12:30

D-80-1
A dark gray fine-grained argillite. This is a long outcrop and approx. 15' high, slight moss cover. Weathered surface appears to be a yellow orange stain from oxidation and a medium gray. Difficult to tell because the outcrop is heavily lichen covered. Outcrop is at the west end of the lake.

Stopped at BH-4 at Devil Canyon. They are almost finished drilling the hole. We got a chance to open a few boxes. The core appears to be quite competent, had no problems with the hole caving. There is probably no significant shear zone beneath the pond on the left abutement. Some massive quartz zones in the core. A lot of sulfide concentrations in the Kag, both pyrite and arsenopyrite (?) and possibly calcopyrite

8-19-80
[#4,3]

It's another cloudy, heavily overcast morning. Will work the right abutement at Devil Canyon, around BH-1 & 2, a traverse will start and finish up above the oxidized cliff in the abrupt bend in the Susitna River.

Watana
2262' @ 6⁴⁰ @ 46°

D-80-2
A dark gray to black argillite. Some cleavage has developed giving the rock a somewhat fibrous texture in places. It is to wet, can't tell if there is any gloss to it and thus slightly phyllitic - don't think so. Pyrite & arsenopyrite cubes in the argillite. Some quartz

stringers are evident on the surface of the outcrop = differential weathering. Has a fibrous to shaly weathering. Small outcrop where we got dropped off. Low grade metamorphism

Elev.

1510' @ 8^25 @ 58°

Very thinly bedding gives fibrous texture on the outcrop

63° 51° SE approx bedding

Quartz vein (~⅞" thick) is isoclinally folded. Small sample. Locate at a later date.

Pictures 17, 18, & 19 ; panorama of opposite side. Notice polished slip face.

D-80-3

A dark gray, charcoal colored argillite. Large cliff face outcrop which appears to be bedding but may be cleavage plane. Hard to tell.

Bedding, large cliff face

68° 68° SE

or cleavage plane

Cliff face breaks up into thin platey pieces

Joints

337° 82° NE closed, plane oxidized v. smooth

- alot of little faces no major joint see going through this outcrop in this orientation.

~336° 77° NE

333° 81° NE

287° 44° SW 3"-2'

Elev. 1481' @ 9^00 @ 57°

D-80-4

A dark gray to charcoal black slightly phyllitic argillite. Slight sheen to the argillite. Some small white quartz pebbles and some small grains of pyrite or chalcopyrite

fairly large outcrop. At least 100' long and 20'-25' high.

Joints:

342°	74° NE	slightly rough plane, close
340°	74° NE	
77°	26° S-SE	
96°	82° S	curved roughly
83°	16° S	
73°	82° S-SE;	closed plane rough

2"-8'

Elev.

1510' @ 9.35 @ 56°

Joints (con't)

60°	78° NW
350°	76° SW-W
90°	25° S

D-80-5

A dark gray very fine grained argillite with small clasts of white quartz and phyllite (?). The clasts are subangular to subrounded. This is a large cliff (massive) outcrop just upslope

from the previous station at its east end. Argillite weathers to a light to medium gray color. Outcrop ~ 50' high ... 100' long

Elev. 1560' @ 9.35 @ 56°

Sample in Dan's pack.

D-80-6

A small outcrop beneath Survey marker DE-X (~8'). A dark gray to charcoal black argillite. Breakage of the rock gives it a fibrous looking texture, lineation of grains. Weathered surface gives the rock a phyllitic texture appearance wise.

Joints:

355°	81° E	
50°	63° SE	
64°	69° SE	possible bedding
348°	77° NE	

on some faces

Elev.

1488' @ 10^{33} @ 57°

visible bedding is the thinly bedded plane
Outcrop stretches down to approx the drillpad

BH-1 1378' @ 10^{49} @ 57°
Photos of Utility people
20, 21, 22

D-80-7

A dark gray fine grained argillite with small white quartz stringers. Small outcrop surrounded by rubble is next to the helicopter pad at BH-2.

Joints:

344°	82°	SW
93°	44°	S
340°	82°	SW
58°	64°	SE

Elev.

1112' @ 11^{24} @ 57°
Weathered surface is a buff + reddish light gray

D-80-8

On the South at the furthest downstream point on the bend. Have a dark gray, fine grained argillite. This is a continuous exposure at the river level. Fairly massive outcrops with very little quartz veins. Very close to Dam axis. Statistically joint analysis of Key near axis. Joints are predominantly smooth surfaces.

Joints:

1) 60° 74° SE, open, plane, slightly irregular
2) 340° 55° NE, closed, curved, slightly irregular
3) 337° 70° NE, plane, closed, smooth
4) 97° 57° SW, plane, closed, slightly irregular, curved
5) 342° 80° E, plane, smooth, closed
6) 57° 72° SE, plane, slightly irregular, closed
7) 75° 78° SE, curved, " " , closed

Joints cont.

8)	45°	23° W, curved, closed, slightly irregular
9)	337°	67° NE, slightly irregular, plane, closed
10)	60°	vert. plane, slightly irregular and closed
11)	125°	16° S, plane, closed, slightly irregular
12)	340°	75° NE, plane, " , " "
13)	70°	55° SE, plane, " , " "
14)	70°	62° SE, " , " " "
15)	53°	30° NW, " , " " "
16)	0°	horiz, " , " " "
17)	18°	73° E, curved, " , " "
18)	80°	67° SE, " , " " "
19)	44°	10° NW, plane, " , " "
20)	340°	90°, smooth, plane, closed
21)	82°	62° S, curved, closed, smooth
22)	325°	27° NE, plane, smooth, closed
23)	353°	74° E, " , " , "
24)	90°	56° SE, " , " , "
25)	90°	33° SE, curved, smooth, closed
26)	58°	32° NW, curved, smooth, closed
27)	82°	62° S, plane, " , "
28)	77°	58° SE, curved, " , "
29)	348°	60° NE, curved, " , open
30)	86°	63° S, plane, " , closed
31)	339°	77° NE, " , " , "

possible slickenside?

32)	84°	64° SE, curved, closed, smooth
33)	115°	24° SE, " , " , "
34)	343°	79° NE, plane, smooth, closed
35)	75°	65° SE, " , " , "
36)	78°	25° NW, " , " , "
37)	338°	82° NE, " , " , "
→ 38)	295°	14° NW, " , " , "
39)	334°	80° NE, " , " , "
40)	65°	32° NW, plane, smooth, closed
41)	58°	27° NW, plane, smooth, closed
42)	85°	65° S, " , " , "
43)	45°	38° NW, " , " , "
44)	106°	55° SE, " , " , "
45)	340°	88° NE, " , " , "
46)	83°	26° N, curved, " , "
47)	20°	10° E, plane, " , "
48)	335°	vert, " , " , "
49)	318°	24° NE, curved, " , "
50)	90°	65° SE, " , " , "
51)	78°	66° SE irr, smooth, plane open
52)	78°, 40° NW	irr, plane, closed
53)	83°, 61° S	curved, smooth, plane, closed
54)	357°, 85° E	plane, smooth, irr, open
55)	85°, 25° W	" , " , closed
56)	86°, 58° S	curved, smooth, closed

Joints cont.:

57.) 3°, 61° W	plane	smooth	part open	
58.) 22°, 57° W	curved	"	closed	
59.) 65°, 72° SE	"	"	"	
60.) 328°, 19° NE	plane	"	"	
61.) 333°, 86° SW	"	"	"	
62.) 335, 11° SW	"	"	closed	
63.) 340°, 79° E	"	"	closed	
64.) 339°, 77° E	"	"	part open	
65.) 40°, 55° NW	"	"	closed	
66.) 48°, 12° NW	"	"	closed	
67.) 340°, 86° E	"	"	closed	
68.) 342°, 86° E	"	"	"	
69.) 63°, 18° NW	"	"	open	
70.) 347°, 70° E	"	"	closed	
71.) 54°, 85° NW	"	irr.	"	
72.) 338, 90°	"	smooth	"	
73.) 65°, 22° SE	"	"	"	
74.) 334, 90°	"	"	part open	
75.) 351, 69° E	"	"	closed	
76.) 332, 69° NE	curved	"	part open	
77.) 68°, 24° NW	plane	"	closed	
78.) 47°, 36° NW	curved	"	"	
79.) 04°, 60° SE	curved	irr	?	
80.) 336°, 78° NE	plane	smooth	"	

81.) 7°, 85° W	curved	smooth	closed	
82.) 37°, 77° NW	"	"	closed	
83.) 341°, 51° E	plane	"	part open	
84.) 339°, 77° NE	"	"	"	
85.) 335°, 72° NE	"	"	"	
86.) 46°, 25° NW	"	irr	closed	
87.) 345°, 82° E	"	"	"	
88.) 78°, 63° S	curved	irr	"	
89.) 340°, 83° E	plane	smooth	"	
90.) 317°, 80° NE	"	"	"	
91.) 37°, 88° SE	curved	rough	"	
92.) 52°, 12° SE	plane	smooth	closed	
93.) 343°, 88° W	curved	"	part open	
94.) 4°, 90°	plane	"	closed	
95.) 18°, 40° NW	"	"	"	
96.) 33°, 20° SE	"	"	"	
97.) 354°, 87° E	"	"	closed	
98.) 77°, 39° N	"	"	"	
99.) 88°, 13° S	"	"	"	
100.) 66°, 84° NW	curved	rough	closed	

Bedding appears to be
73° 55° S

Plotted on red sheet TS
by June 3 for 1981

Photo of opposite cliff #24
Outcrop weathers to a greenish gray, dark red, & gray.

Continuous outcrop along river can be seen in traverse from #8 - #

D-80-9
A small outcrop of the medium to dark gray argillite, fine grained. Outcrop ~ 20' high and 80+' long. Some pyrite conc. in cube shaped cavities. Pyrite has grainy texture

Joints

56°	62° SE
348°	85° SW
20°	80° E
50°	74° E
80°	21° N

Elev. 1034' @ Z37 @ 60°
This outcrop stretches for over 100' off and on

D-80-10
A large outcrop on the Susitna. A reddish tinged dark gray, fine grained argillite. Seems to be fairly homogeneous. No bedding easily seen. Weathers to a light gray color (?).

Joints:

343°	4° NE	1' - 3'
345°	65° NE	
74°	63° S-SE	
27°	48° E-SE	
334°	10° SW	

approx 150' upstream, looks of quartz and significant iron staining

D-80-11
In the little creek north of Cheelsako fan there is an exposure of a non-stratified well sorted deposit. It is approx 50'-60' high. It is a fine grained sand to a clayey silt matrix w/ mostly pebbles and gravel

and only a few boulders. The clasts are subangular to subrounded. They do not exhibit any striations, polish, or facets. It is probably a till though because it has a silt/clay content, it is semicompact, and non stratified. Take that back a very few striation are seen in this sandy till (?)

Elev. at base.

952' @ 3⁴⁷ @ 60°

D-80-14

Contact between argillite and white appears to be a white quartzite which has only slightly metamorphosed. Not sure if this is what it is. The white rock weathers to a yellow-orange oxidized stain. Has some small crystals of . Rock doesn't ring like a quartzite. This can't be explained by the fracturing. Sharp contact between the two. Could this be a felsic dike?

Wintana 221' @ 6⁵⁵ @ 48°

Flagged most of our stops today as it was extremely difficult to locate ourselves on the photos. Are requesting new blow-ups of the site.

Saw at least 17 moose on the way back. Also saw a good stratified unconsolidated material exposure north of Borrow site "E".

Snow was evident in the peaks this morning to the north.

8-20-80
[#4, 8]

It's overcast again this morning and very wet. Last night it rained pretty hard, snow is evident on the Talkeetna Mtns to the south. It isn't a thin cover on the higher peaks either.

Will work on the river on both abutments just downstream from the proposed dam axis. After this is completed we will fly around making stops.

Watana
2262' @ 8⁰⁰ @ 44°

D-80-15.
Dark gray to charcoal, fine grained argillite. Weathers to a dark gray which is oxidized in place. Outcrop is right on the river. Continuous outcrop

along the river here, can't walk any further downstream, cliff. Moderate to high jointing

Joints:

	25°	72° E	
III	117°	44° S SE *	100/55 I
	122°	53° S-SE	
	110°	65° S *	
	34°	75° E	
	125°	50° N	

D-80-16
Possible zone of contact metamorphism
Outcrop is a porphyritic medium to dark gray (granoblastic ?) argillite. Has inclusions of quartz grains and some alignment of the host rock minerals. Small quartz stringers throughout. This is in contact w/ a quartz rich granodiorite. Weathers to a white gray color. Granodiorite has a medium grained texture. Strike is ~ 100 for the contact. Granodiorite is

* dip is ~ vert.

crystalline and is composed of quartz, feldspar, biotite. Outcrop on the west diorite is equigranular.

Joints:

see Dan's book

Samples taken

D-60-17

Outcrop has both the argillite and the dioritic rock. Appears that there is a felsic dike (dioritic material) which has intruded the Kg. Kg is altered somewhat, its a medium a medium gray color, coarser, and has more of an igneous texture.

Joints - no major set

96°	74° S.
77°	76° N
42°	87° SE
334°	48° SW
69°	85° NW
7°	35° E

A little further upstream contact area can be found again. It's likely it's a chill zone, contact metamorphism has given the argillite and felsic material a different texture. Can't get any orientation on the dike

Joints:

* 310°	12° NE	IV
100°	46° S	
355°	82° W	I
110°	52° S	
6°	84° W	II

Phyllite next to the dike, good shear, foliation is near vertical

6° 78° W don't think its bedding

Finally picked us up and moved us to the other side, left abutment had a problem with getting as far as we had hoped. Once we moved up in elevation above a cliff, we couldn't get down.

D-80-18

Dark-gray to charcoal, fine grained argillite. Kag is a little shaley and slightly phyllitic, low grade metamorphism. Weathers to a dull dark-gray w/ some oxidized surfaces.

Bedding

79° 54° S

78° 50° S

86° 44° S

Kag is very thinly bedded. Outcrop is right on the river.

Joints: no major joint faces

4° 80° NW

45° 32° NW

352° 60° W

Spunky picked us up on the river and moved us to knob on right abutement.

D-80-19

Large outcrop on knob, up above the canyon site on the right abutement. A white-gray inequigranular crystalline biotite granodiorite (Tbgd). Porphyritic may still apply to this rock.

It has a fine-grained groundmass with medium to coarse grained phenocrysts. Can see biotite, plagioclase, and quartz. This knob has about a ≈50% exposure w/a thin vegetation cover. C.I ≈ 10%.

Elev. 2203' @ 2[53] @ 56°

Joints:

115° vert.

44° 60° SE 1'-2'

45° vert.

325° vert. I

Outcrops to a buff gray w/ the white coarse grained xtals evident.

D-80-20

Small outcrop on knob w/ thin vegetation cover. Dark gray fine grained argillite (Kag). It's not phyllitic at all and no quartz can be seen. Weathers to a

buff color. Found quartz stringers on an adjoining outcrop, up to 2" wide and they have been folded

Elev. 2205' @ 3rd @ 56°

Joints.

335°	80°	SW
132°	88°	S-SW

Finky dropped us upstream of Cheechako Creek on the right abutement

D-80-21

A large cliff outcrop on the river. The rock is dark gray, fine-grained, argillite with numerous quartz stringers. The quartz stringers have been folded and possibly fractured. The outcrop weathers to dull gray except where oxidation has been intense.

Joints:

329°	77° NE
310°	82° NE
86°	86° N

Has a layer of clean sands at the base of the outcrop. It is a white sandstone or orthoquartzite which is thinly bedded.

D-80-22 150' upstream

Large cliff outcrop continuing upstream. Find phyllitic argillite in contact w/ the granodiorite which is in a dike. On the downstream side, we have a white rock which may be a meta quartzite or color change in the argillite(?), unsure. Higher concentration of fractures

Dike 280° vert.

D-80-22

Contact of the argillite (Kag) and the biotite granodiorite (Tbgd)

The argillite is mostly altered and highly fractured next to the contact the argillite has a spacing of 1"-1' and is weathered to a buff gray which is in places slightly oxidized. The Kag is a light white gray color mostly and may not be argillite but an orthoquartzite or something. The biotite granodiorite is fine to medium grained, is white-gray, crystalline rock. CI ≈ 10-15%. Tbgd contains quartz, plagioclase, and biotite. Contact is nonconformable, Tbgd is much more massive although it

Joints:

	115°	80° S
	63°	66° SE
	96°	58° NW
*	350°	78° NE
	357°	76° E
	77°	75° SE

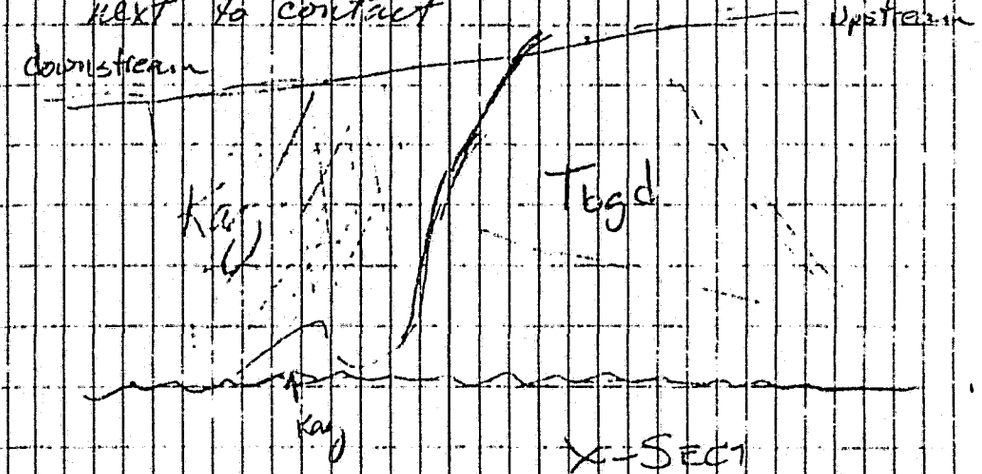
	57°	56° SE
all in Kag	337°	75° NE
	325°	27° NE

Shear zones in Tbgd

two prominent joint sets	biggest → 64°	56° SE	~1' wide, breccia or highly fractured zone
	8°	26° E	2-3" wide

- no slicks or gouge material, fractured appearance gives it shear look.

has shear zones. Flagged w/an "X" next to contact



Outcrop is approx 50'

D-80-23

walk upstream all rides at river edge to Kag, Dan went to an outcrop ≈ 80' above the river level and it is ≈ 50' high, to check rk types.

Figuring its Kag, I backtracked to pick up the change.

Stopped at first outcrop, walking back downstream

D-80-24

Tbgd, small cliff ~ 20' high 70' long. The gray-white fine to medium grained biotite granodiorite. Outcrop is massive

Joints:

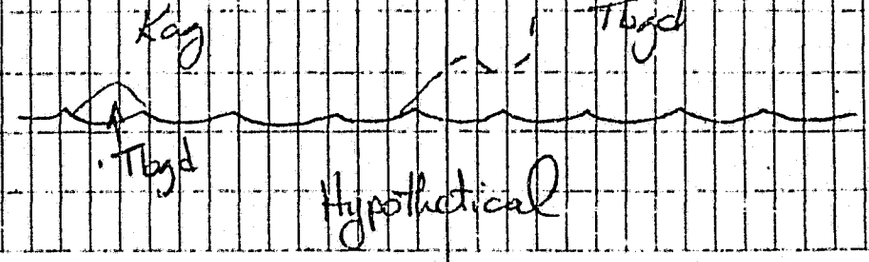
291°	83° S
1°	82° W
87°	67° N
316°	11° S

Small amt of phyllite and chlorite in contact with the amount on cliff face Flagged

Tbgd is 80 paces wide, on river ≈ 240'

Within 2250' @ 7.00 @ 1/8°

East of Devil Canyon on the Susitna River, there is a change from the Kag to the Tbgd. This again changes back to Kag after ~ 240' of walking upstream. The non-conformable contact is a zone of interfingering or underlapping



On the right abutement just above the dam site, there is an outcrop of Tsgd, Csejtey has it as all argillite. Check for further discrepancies.

8-22-80
[#4, 22]

It's a cloudy morning, it rained hard here last night but it snowed again in the mountains (i.e. Talkeetna Mtns). The snow as at its lowest elevation so far. Burned off, could see McKinley.

Went to Devil Canyon for a couple of hours and then at 10:00, I went on the WCC review

Watana 2262' @ 40° @ 8:00

D-80-42

Outcrop is a large cliff on Cheechako Creek. Have a biotite granodiorite. CI = 15. Lots of quartz, biotite and also plagioclase. It's a grayish white medium to coarse grained rock. It's massive, weathers to a pinkish gray. There is at least 20% quartz

Joints:

*	358°	76° NE
*	315°	84° S
	100°	18° N

Elev. 1728' @ 9:10 @ 53°

D-80-43

Right abutment of Cheechako Creek. Small outcrop of Kag, the dark gray, fine grained, slightly phyllitic in places, argillite. Outcrop approx 30' across & 6' high. In between bedding planes the Kag is oxidized. Weathered surface is a buff light to medium gray some Fe staining.

Bedding

98°	64° S
94°	64° S

Joints

* 15°	76° W	2"-1'

Elev.

1682' @ 9:45 @ 58°

A little bit of quartz in the Kag.

D80-44

Contact area of Kag & Tkgd. It's not a disturbed contact. Left Dan here to work, I'm going on the WCC review.

Elev.

1854' @ 10:12 @ 59°

Arrived at High Lake, 10:30

Flew to Hurricane for refueling, photo's of rock glaciers, McKinley, and Hurricane. Then proceeded on to the McKinley strand of the Denali fault near the Cantwell glacier, photo's of strand (scarp), right lateral offset of ridge. Flew east along the fault, photo of West York Glacier. Then flew down the Susitna fault.

Talkeetna thrust - Susitna River

STRIKE OF TERT CONGL

180° 25° W

possible slump block thru

~~325° up~~

right abutment

200° 45° W

Susitna River - right abutement

Strike of possible fault in Outwash

N44E 65 SE

.7" displacement

unit on same section.

Disproved this as a possible fault.

WCC review went fairly well today. Suggest

8-23-80

[#4, 28]

It's a beautiful clear morning but its cool. Dan will work in the Devil Canyon area, just upstream of the dam site. I am going on the WCC review this morning.

WCC REVIEW - Flew over to where the Talkeetna thrust crosses the Susitna River. Proceeded to look for any surface lineament as defined in the U-2 CIR photo 3 which Tom Freeman pointed out. This proved to be a good idea because of the sun and low sun angle. Proceeded to Fog Creek to look at the TV although we ended up looking at Kag too.

Flew to Devil Canyon, lineament at Cheechako Creek, left abutement and the thrust

fault exposures east of Portage Creek.

Photographs of McKinley finishing up one roll, next roll of McKinley, Stephan Lake, moraine south of Fog Creek Talkeetna thrust lineament and Susitna River looking west from near Watana Creek.

AFTERNOON – V. Singh & Henschel accompanied me to Borrowsite D (made a stop) and Watana Creek to look for lacustrine sediment (made a stop). Neither site was considered to be good (V. Singh)

[illegible] granodiorite

8-24-80

[#4,35]

It's another beautiful stal clear day, the third day in a row. Will work on the left abutment at Devil Canyon, along the access road w/ special emphasis in the contact area Kag & Tbgd south of the dam site. Dan and I are working together

Watana

2262' @ 8:55 @ 47°

D80-60

A dark gray, fine grained, slightly phyllitic argillite. There is some white quartz stringers and pods in this outcrop. We are at the edge of this on and off again exposure near the north edge of the clearing.

Elev.

1315' @ 10:04 @ 57°

Joints:

62°	84° [illegible]
355°	88° E
72°	62° SSE
57°	37° NW

D-80-61

Walked along the cliff, found the whitish-gray granodiorite. No biotite in it and is a little finer in texture than normally, medium grained. It may be a dike or it is near the contact. Will have to see how far it continues

Joints:

295°	83° SW
353°	83° W
357°	54° E
357°	39° W

Section of the long outcrop is covered w/ vegetation in place. Can't see any contact zone. Flagged the dike

Walking further went back into Kag (walked SE). Small zone of granodiorite 10'-20'

D-80-62

The dark gray, fine grained argillite. Small outcrop. Will not see another outcrop until we are over at Cheechako Creek, just above it.

Joints:

273°	43° S
340°	vert.
35°	69° NW

Bedding 65° 55° SE not sure but the Kag breaks along this plane very easily.

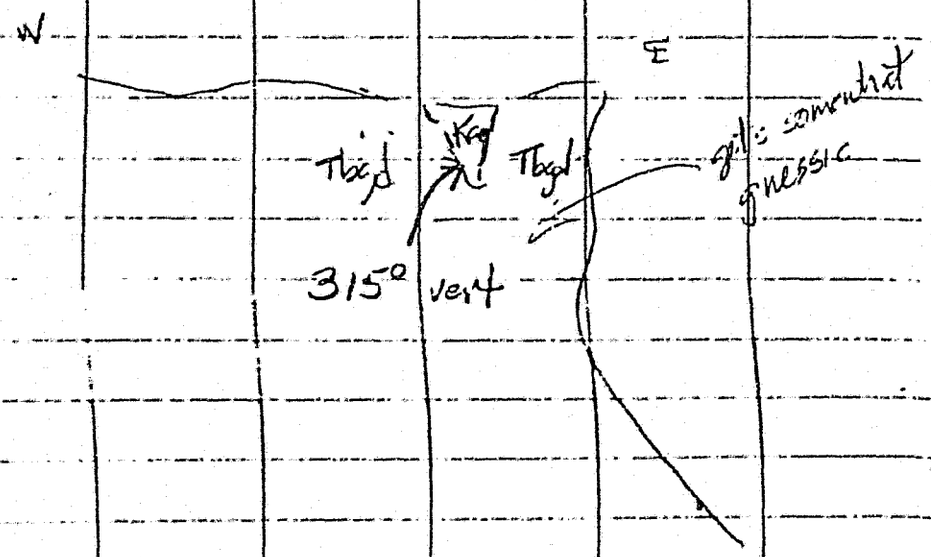
D-80-63

Top of cliff on left abutment of Cheechako Creek. Contact zone between the dark gray, fine grained argillite and the grayish white biotite granodiorite. The Kag / Tbgd contact is sharp, see the sample taken. It's an interfingering

Joints

	46°	70° [illegible]
	54°	67° SE
*	317°	85° NE
	349°	66° E
	299°	35° NE
	275°	83° S

contact.



low grade metamorphism. Sampled Biotite shows some orientation.

Between station 62 & 63, mostly Kag float rock

For all intrusive purposes, this is a granodiorite, biotite rich

D-80-64

A grayish-white, medium grained, biotite granodiorite, CI = 15-20%

Quite a bit of quartz 15-20%.

On the nose of the cliff. Followed a little ridge out to this point

Tbgd is slightly oxidized

Joints:

102°	82° N	4" to 1½"
104°	84° N	
327°	87° SW	
326°	88° NE	

D-80-65

Small outcrop ~ 10' high and 30' long of the dark gray fine grained argillite. It weathers to a light to medium gray color. Don't see any quartz stringers.

Bedding

273° 85°S

1837' @ 2^30 @ 68°

D-80-66

Small outcrop of the light gray, fine grained slightly phyllitic argillite. Beginning to get quartz eyes between the bedding planes. Found a quartz pod within. This outcrop is along the road.

Elev.

1862' @ 5^05 @ 69°

Joints:

22° 82° E

82° 77° N

Walked ~ 100' west, took an S&D on the phyllite (lot of sheen) and it is in contact w/ Tbgd which is exposed for 30'. Tbgd is finer grained here. — Dike or small stock

D-80-67

A dark gray with some grayish white, fine grained, slightly phyllitic argillite. It has some quartz, fine grained sand as thin little lenses < 3/4". Outcrop is opposite the small pond. It's approx 20' high at least 30' across. Kag

Elev

1857' @ 3^27 @ 69°

has some sheen to it.

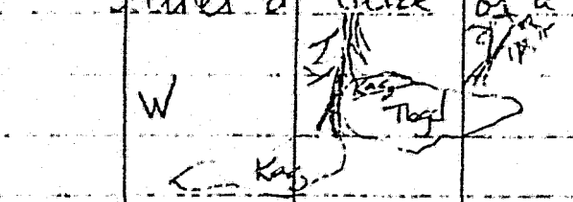
Weathers to a yellow dark greenish gray or a charcoal.

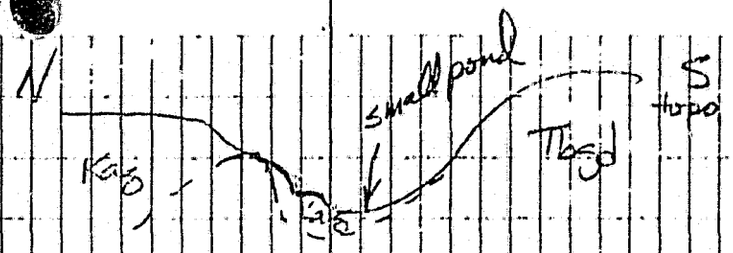
Approx bedding
72° 86° S-SE

Joints are approximate:
344° 27° NE
348° 74° NE
342° 68° SW

D-30-68

Small outcrop just above the road. Kag at the bottom of the outcrop and Tbgd at the top. The biotite granodiorite is fine to medium grained and a white gray color. CI = 10%. The Kag is a pink medium gray, fine grained. Kag exhibits less bedding than usual. It has probably undergone some contact metamorphism. Tbgd is either a dike or a small stock.





Joints
58° 59° SE
348° 84° W

106 paces west on road from edge of small pond to this outcrop 108 = 325'

Watama 2304' @ 5° @ 64°

8-26-80
[#4, 41]

Devil Canyon, mapping the left abutment from the airstream, downstream. Dan and Jan Hagen will map this area.

D-80-69
lge Outcrop Kag ~100' up from river, fine grained, brown ARGILLITE to sub PHYLLITE (luminescent sheen) weathers to scoracious, light brown, buff
bedding ~ 258°, 65° SE
240° 60 SE
joint sets: 2 prominent
(1) coincident w/ bedding,

		Spacing
270°,	60° SE	1' to 3'
(2) 155	90°	.5' to 3'

- climbing up top of outcrop becomes more quartz rich, phyllitic

outcrop is continuous
175°, 88 NE - bedding

joints:

		Spacing
180°,	85° NE	.5' to 1.0', v. close
167°	88° NE	
272°	80° NW	.5' to 1.0 v. close
305°	42° N	.2' to 1'

D-80-70
- encounter pale pink/tan felsic dike near canyon ridge
- appears sugary, fine grained with inclusive, euhedral quartz crystals
- intensely fractured, irregular - cooling phenomenon?

D-80-72
Dark grey PHYLLITE w/sheen, displays grain lineation; quartz stringers occasional, weathers to pale grey/brown, lichen and moss covered
joint ins:

275°	480 SW	.5' to 1.0'
305°	50 W	"
15°	80° W	"

- localized deformation around quartz

D-80-73

- lge outcropping at canyon edge, slumping has occurred to a degree
fine grained, dark grey meta-ARGILLITE with high % of quartz in stringers and massive

- jointing is very close to close
17° 65° E
35° 72 E
120 76° N < less prominent set
140° 68° N

- walking along canyon edge:

open joint observed, aprox .5" separation
orientation
295°, 86° S.

D-80-74
- Kag - META ARGILLITE to PHYLLITE, dark grey, fine grained with sheen
- outcrop displays prominent jointing oriented 15° 60° E, often separation up to 6" seen along this plane

joints:

		Spacing
14°	70° E	average < 1.0'
5°	58° E	

D-80-75

joints		Spaced
235°	80 SE	1' to 3'
open 142°	- vert.	5" separation, 1" to 4"
135	- vert.	
226°	68° SE	open, 1" separation
62°	70° S	open fracture, slumping along

D-80-76
- Phyllite, dark grey with quartz layers, bedding 42° 84° SE, fissile
- along canyon edge, separation along joints as well as bedding contribute to overhang into canyon and slumps

joints:
35° 73° SE } often open
28 78° SE

spacing
122 68° N 2" to 12"
138 60° N

- aprox 50 yards W of D-80-76
W outcrop of aphanitic, felsic, siliceous material (different from sugary dike of this morning)
- prominently jointed: spacing
105° 82° N 2" to 8", tight
108 75° N
- Fe rich stain - weathered surface

D-80-78
Outcropping of fine grained, dark grey PHYLLITE, fissile, quartz intrusions occasional

joints

175°, 85 NE
276°, 68° S open, 3" separation

Field notes by Jan Hagen

8-28-80
[#4,53]

Dan and I will work on the right abutement across from the fan or stream terrace. T. Drexhage is showing R. Henschel how to use the borehole camera.

It rained most of the night and there is definitely snow on the peaks. Right now it is cloudy right down to the river in places.

Watana 2262' @ 7^{46} @ 52°

D 80-89
Outcrop along the creek, north of Devil Canyon. It's approx 4-5' high and 30' long. Outcrop of the dark gray, fine grained argillite. Weathered to a buff-gray color. It has little quartz stringers in the rock. This creek is now named Brush Creek because of the

High, thick, wet brush that we have had to walk through.

Elev. 1740' @ 10^25 @ 57°

D-80-90

Edge of cliff face, south edge, just above the river bend. We used the entire cliff face to traverse downstream, south. Here we have a medium gray fine grained, graywacke. The outcrop is oxidized in places. It looks like the graywacke unit but it could be the weathered argillite unit. Outcrop is 15' high and 35' long. Massive

Elev.

1535' @ 11^42 @ 58°

Cliff face

350 66° E.

D-80-91

On left abutment of "Brush" Creek. Large outcrop of Kag, the dark gray to charcoal, fine grained slightly phyllitic argillite. There is some sheen to the rock, it has quartz stringers in it with some sulfides (pyrite?) along the stringers. I'm at the base of the exposed rock (elev) and beneath here there is a sandy blocky talus slope. The Kag weathers to a light medium gray and it is oxidized in many places.

Elev

1298' @ 12^26 @ 56°

Joints:

334° 20° SW

351° 53° NE

[illegible] 83° S-SE

Bedding
58° 68° SE
- jointed along this plane (?)
spacing of 6" to ~2'
- major jointing & believe
its bedding

D 80-93
Cliff of unconsolidated non-stratified material ~ 90' high. It is a fairly dense material with mostly a fine to medium grained sand matrix although in places it is a sandy clayey silt or silty clay that's plastic. Cobbles and boulders are ~ 30%.

Elev. MID 996' @ 2.47 @ 57°

Elev. Bot 933' @ 2.53 @ 57°

Alot of the cobbles and boulders (up to 3.5') have rounded edges and are elongate.

The sandy nature and the lack of roundness make this unlikely for outwash. Some clasts have striations, very few, and the steepness of the cliff and compactness of the material indicate it may be a till. It could have been possibly reworked or ablation till.

Most boulders are < 8" in length, alot of pebbles

Susitna river @ 892'

W-80-94
At large outcrop on right abutment of the Susitna. Cliff comes down to river level. Kaq, a dark gray, fine grained argillite with some thin clean fine grained sand layers. Alot of quartz stringers

Bedding
66° 79° SE

Kag weathers to a dull medium to dark gray and buff to orange color where oxidized. Massive and blocky.

Joints.

327° 78° SW
84° 12° S 1'-3'
326° 77° SW

All joints except 327° are irregular, rough.

75° 62° intensely fractured zone spacing slaty to 4"

Top or midway up the Cliff
Contact of Kag and a dike?

Elev. ~~[illegible]~~ 1045' @ 4^{12} @ 58°
contact - is sharp probably a dike
330° vert.

Kag above contact is a purplish brown rock. Below there is a zone of grayish-white (bleached) and a highly oxidized zone,

light orange color. May be an acidic dike, has small quartz xtals (smoky) in a white plagioclase ground mass, probably from the Tbgd. Below this is the Kag again - see first description.

Sampled the oxidized or dike zone. This lower zone of the oxidized zone is probably argillite

Watana 2238# @ 6^{06} @ 52°

8-29-80
[#4,57]

It's a cloudy and overcast day, it looks like rain. It's 58° (10°). Review Dan's work in Portage Creek

D-80-54

Shear zone in the Kag. A bleached or white zone of [illegible] gouge? which has extallized. Has breccia of unaltered argillite. Slickensides - see Dan.

D-80-95

Large outcrop on the creek below the mine. On right abutement ~ ≈120' by 10'-40' high. Kag - ~~dn~~ medium gray fine and medium grained argillite w/ small quartz xtals

Has one strong parallel joint set 22° 53° W-NW 1"-2'. It may be bedding but its difficult to tell. Some of these joints are shaly weathering zones. It has some quartz stringers ~1mm thick

Joints:

353°	79° E
292°	69° N
273°	82° N
27°	82° E
53°	62° NW
22°	53° W-NW
52°	60° NW
326°	80° NE 1"-6"

D-80-96

Dan is doing the rk outcrop here. I'm doing the unconsolidated material. Exposure is ≈ 120m, the whole outside of this bend and averages ~60' high. Material

ranges from a gray clayey silt to a medium grained sand with or without lots of pebbles and cobbles. The deposit is stratified. Pebbles and cobbles have rounded edges and some are rounded (few) to subrounded. Not sure if there is any till. Possibilities

1.) Outwash from a fluctuating ice margin
2) Possibly associated w/ proglacial lake

Saw possible lateral moraine, fault area to check next week. Back to Watana, work on Fog Creek.

9-4-80
[#4, 59]

It's a beautiful sunny day. Worked in Fog Creek this morning south of. Will now work upon Portage Creek and the area of the thrust.

Watana 2262' @ 11°4 @ 62°

D-80-97

Stop near the thrust fault, Scarp, or ridge with outcrop of the Kag. It's a dark gray, fine grained phyllite which is foliated. It's oxidized. Scarp has solifluction folds which are accented by the snow - NW slope

D-80-98

Mainly a light green, fine grained andesitic basalt. Very blocky texture. Close up it looks dark with small white plagioclase [illegible] [illegible] [illegible] of [illegible] [illegible] [illegible] volcanic.

Joints:

329°	84°	SW
62°	51°	NW
272°	86°	N
285°	65°	N
328°	84°	NE
82°	66°	N
39°	12°	NW

D-80-99

Very flat terrace, no striations on the cobbles.

D-80-100

Exposure of a clayey silt w/ no sand to cobbles. Silty sand, w/ pebbles and cobbles generally less than 6" [illegible]. This could very likely be a lateral moraine. Clasts subrounded to rounded. Silt in matrix can be associated with meltwater. Very broad flat terrace.

Elev.

1549' @ 2^{45} @ 60°

Some striations on two clasts?

D-80-101

Whaleback on top of this knob. Outcrop of the dark gray fine grained argillite. Weathered surface on portion of the outcrop seems to contain pebbles - maybe some

Elev

2493' @ 4[illegible] @ 45°

conglomerate in the Kig

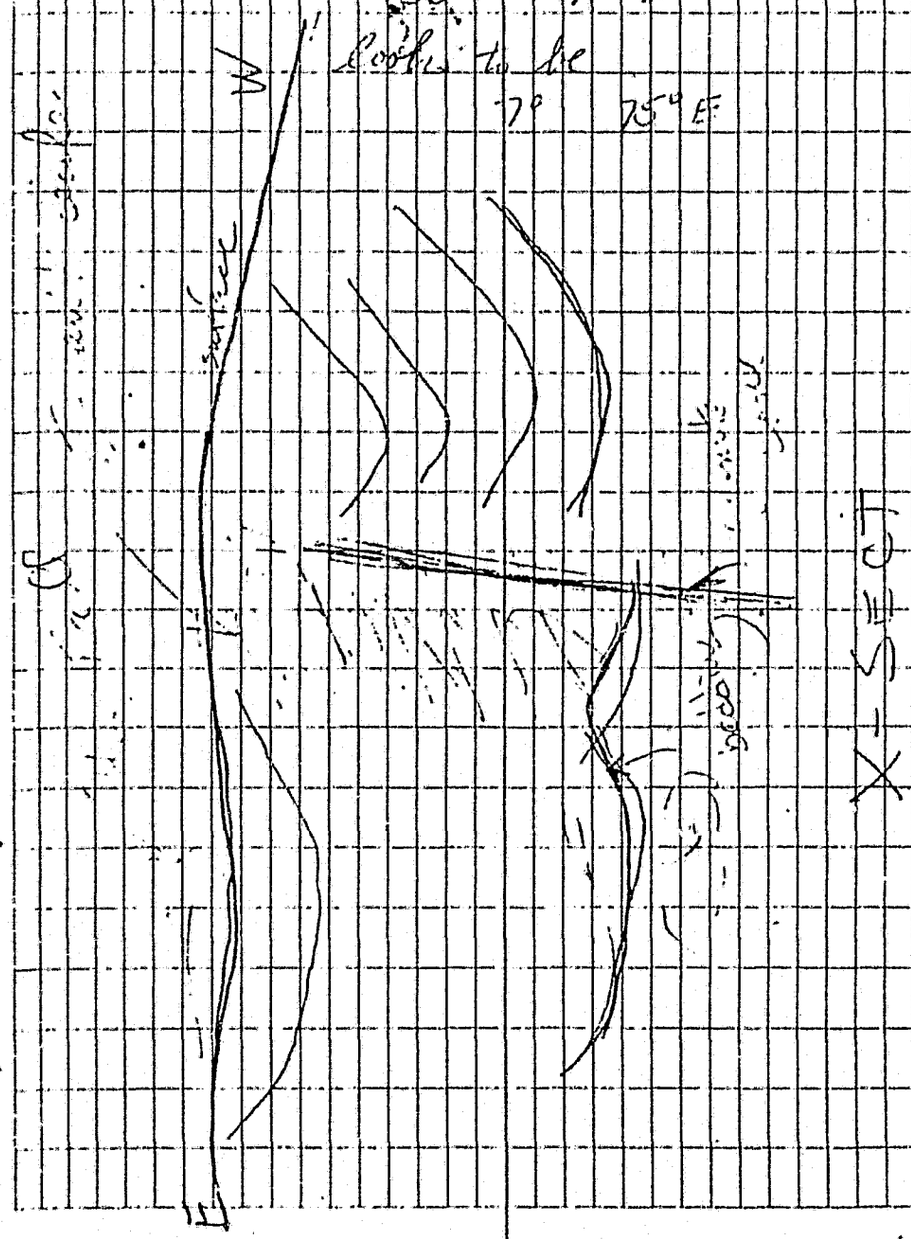
D-[illegible]

Large outcrop of a gouge
Over a [illegible] vertical [illegible]
[illegible] is the medium [illegible] gray
argillite with numerous white
plagioclase veins and some clayey
gouge zones. The plagioclase
in places has been [illegible] to
clay and it has contains pyrite

Bedding 283° 37°S

Rock is highly [illegible] some
[illegible] (possible faults [illegible]
[illegible] (in [illegible]
One clay zone [illegible] lower
part has [illegible] green
[illegible] clay [illegible]

Orientation of xylonite zone
250° 70°E
looks to be
7° 75°E



Elev. 1637' @ 6[24] @ 48°

[illegible]

[illegible] @ 6[illegible] @ 3[illegible]°

AIR PHOTO:
4-1-7
4-2-9

9-5-80
[#4.63]

It's a cool, mostly sunny morning. Will work on the right abutment at Devil Canyon from just downstream of [illegible] on the crest, and work downstream.
Color photo # 1-1-2
Watana 2262' @ 7[31] @ 33°

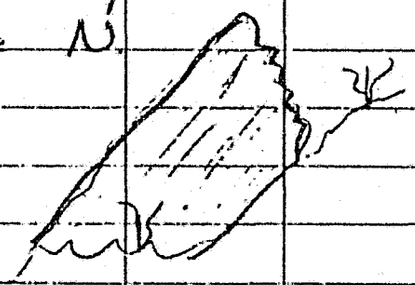
9/5/80 Traversed West ~150 yds of Corps of Eng. drill site on N side of Dev. Can. Dam. site, Found outcrop ① 103 of Argillite, dark gray, fine, siliceous, sl. foliated on outcrop face, fresh break shows Fe stains and Pyrite cubes weathered, Outcrop faces west. El. 1642'

104 ② Outcrop, Traversed below Outcrop ① ~150', Outcrop faces west, Argillite w/ Sulfides, Fine w/ sl. sheen, Sl. foliated, Qtz veins exposed - intruded along foliation plain - irregular, Arg. dark gray on fresh surface - siliceous

6a 7/5/80 Cont.

106 Outcrop ③ Argillite-Phyllite, foliated, sl. fissle, Festained on jt. surface, dendrites Mn? - oxidized, Pyrite grains oxidized, Outcrop faces East, Jt. Face strike N.

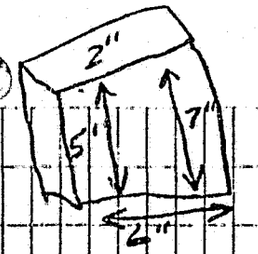
El. 1480'



107 Outcrop ④ Argillite-Phyllite, dark gray, fine, conchoidal fracture, Festains Common, Pyrite cubes weathered out, blocky Frags, Outcrop faces East, Num. Jointing Planes

108 Outcrop ⑤ Argillite w/ Qtz stringers, dark gray, Fine, oxidized on Jt Surfaces, Faces ~West, Blocky, long linear outcrop, 1725' EL

109 Outcrop ⑥ Located Dike, spotted from Helicopter, More oxidized - Festained than Argillite-Phyllite Outcrops. Basicly Med. to Coarse Grained White Crystaline Matrix w/ Some Qtz < 2mm, Weathering penetrates into rock, Cooled Liquickly due to small crystals present, dike derived from Diorite intrusion to the south. Sulfides weathered, Stream running down strike of dike, Weathers to



Elev. 2374' @ 6:32

Altered our plans for today. Started approx. 11:30 w/ Dan and Rick Rahiem (who used this book) working on the ground and I directed them from the helicopter until Pete & I had a problem with the ship, something was burning. It turned out that one wire had fried.

9-9-80

It rained and snowed last night. Right now its mostly sunny to the west and it's very cloudy to the east. Will look at the borrow material for Devil Canyon and look for additional sites

Watana 2262' @ 7.50 @ 40°

9-12-80
[#4, 89]

Will due joint measurements at Devil Canyon, left abutement near the Dam axis, this afternoon.

t = tight
p.o. = part open

D-20-173 DCV-1

1. 334°, vert; smooth, plane, hematite staining, +
2. 337°, 88° NE; " " " " , p.o.
3. 4°, 20° E; irregular, plane, p.o.
4. 55°, 79° SE; smooth, plane, +
5. 44°, 20° NW; plane, smooth,
6. 332°, 86° NE; plane, smooth, +
7. 100° 58 SW; rough plane, p.o.
8. 328°, 85 SW; smooth plane, +
9. 342°, 81 E; smooth, plane, +
10. 334°, Vert; smooth, plane, open
11. 342°, 78° NE smooth, plane, tight
12. 331°, Vert; smooth plane p.o. hematite
13. 337°, 85° NE; smooth, plane, tight

use all this as title

14 336°, 23° NE, irreg. plane, p.o.
15 343°, 87° SW, smooth, plane p.o.
16 21°, 76° SE, smooth, plane, tight
17 337°, 28° NE, irreg. plane, p.o.
18 236°, 55° SE, irreg. plane, tight
19 78°, 56° SE, irreg, plane, tight
20 62°, 63° SE, smooth, plane, tight
21 346°, 17° NE irregular plane, tight
22 336°, 83° NE smooth, plane, tight, hematite
23 76°, 62° SE, irreg. plane, p.o.
24 5°, 65° SE, smooth, plane, tight
25 321°, 34° NE, smooth, plane, tight
26 330°, 77° SW, smooth, plane, tight
27 333°, 84° SW, irreg. plane, tight
28 327°, 85° SW, plane, smooth, tight
29 338°, 86° SW, plane, smooth, tight
30 300°, 82° SW, irreg, plane, tight
31 64°, 29° NW, irreg, plane, tight
32 342°, 85° NE, smooth, plane, p.o.
33 53°, 56° SE, wavy, smooth, tight
34 64°, 65° SE, smooth, plane, tight
35 338°, 86° NE, curved, plane, tight
36 67°, 42° SE, irreg, smooth, tight
37 344, 82° SW, irreg. plane, part open
38 272°, 55° NE, irregular, plane, tight

39 327°, 56° NE smooth, plane, tight
40 300°, 50° NE smooth, plane, tight
41 347°, 15° NE, smooth, plane, p.o.
42 340°, 80° NE, plane, smooth, tight
43 80°, 43° N, plane, rough, p.o.
44 55°, 56° SE, plane, smooth, tight
45 343°, 82° NE, plane, smooth, tight
46 358°, 13° E, plane, rough, tight
47 41°, 75° SE, plane, rough, open.
48 63°, 38° NW, rough, irreg, p.o.
49 338°, 85° NE, plane, smooth, tight.
50 56°, 30° NW, rough, irreg, p.o.
51 75°, 41° SE, rough, irreg, tight
52 272, 41° SW, rough, irreg, tight

Oct. 2, 1980

Returned to Devil Canyon at 12:00
will finish these joint measurements.

53 342°, 89° SW, plane, rough, open
54 325°, 80° NE, " , " , closed
55 38°, 28° NW, irr, rough, "
56 49°, 39° NW, irr, " , "
57 348°, 84° NE, " , " , "

3' [illegible]

56	334°, 90°	Plane,	rough,	part open
57	73°, 45° SE,	"	smooth,	closed
Pasture [illegible]	336°, 68° NE,	Irr,	rough,	open
	97°, 72° S,	Irr,	"	"
	342°, 87° NE,	Irr,	"	part open
	340°, 77° NE,	"	"	"
	36, 58° SE,	plain,	smooth,	"
	343, 88° NE,	"	"	closed
	339, 36° NE,	"	"	part open
	70°, 56° SE,	"	"	"
	60°, 39° SE,	"	rough,	"
	341°, 89° SW,	"	smooth,	closed
	70°, 39° SE,	curved,	"	part open
71.	63°, 57° SE,	plane,	smooth,	closed
72.	36°, 8° SE,	"	"	"
73.	329, 78° NE,	"	"	"
74	40°, 68° NW	curved,	rough,	"
75	[illegible]°, 77° NW,	"	"	"
76	13°, 65° W,	"	"	"
77	305°, 87° NE,	plane,	smooth,	closed
78	[illegible]°, [illegible],	"	"	"
79	[illegible]°, [illegible] SW,	"	"	"
80.	[illegible]°, 30° [illegible],	"	rough,	p. open
81.	31[illegible]°, 63° NE,	plane,	smooth,	closed
82.	34[illegible]°, 20° NE,	[illegible],	smooth	closed

83	340°,	[illegible]° NE,	plane,	smooth,	closed
84	25°,	65° NW,	plane,	rough,	p. open
85	340°,	84° NE,	"	smooth,	"
86	26°,	67° NW,	"	rough,	"
87	30°,	70° NW,	"	"	closed
88	30°,	67° NW,	curved,	"	p. open
89	30°,	65° NW,	plane,	"	"
90	350°,	84° SW,	"	smooth,	closed
91	20°,	68° NW,	curved,	rough,	"
92	18°,	64° SE,	plane,	[illegible],	"
93	344°,	82° NE,	"	smooth,	"

25 to 3'

Plotted on the red sheet TS
Dt. July 1st, 1987

9-19-80
[#4, 111]

It's another beautiful, clear, sunny day. Will redue the first traverse we did on the right abutement (8/ /80). After on the left abutement, a few stations will be rechecked, from the point bar to the dam axis. D-80-2 to D-80-6

Watana
2262' @ 8°° @ 42°

D-80-[illegible] is the landing site

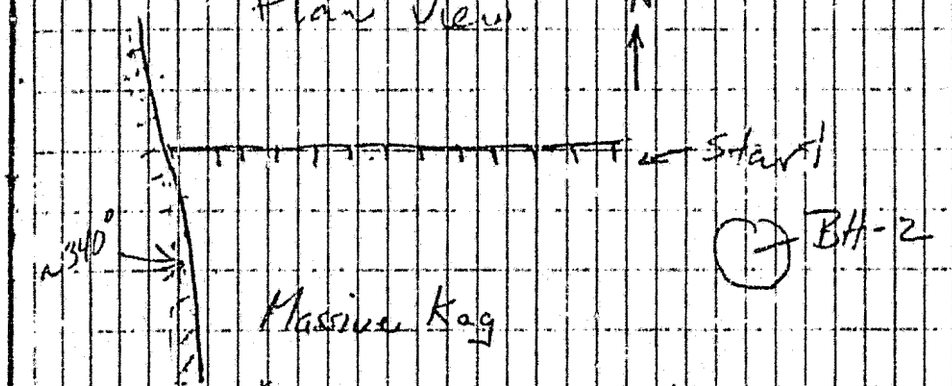
D-2-80

Continuation of joint measurements
See page 73 for this days work

D-80-172 or D.C.-5

Just above BH-2 and a little downstream, Cliff stretches downstream for several hundred feet. Elev. ±

Plan View



@ #53 began on 34° diff

1. 337°, 77° NE, plane, smooth, open
2. 337°, 32° NE, " , rough, closed
3. 77°, 0° NW, curved, rough, open
4. 338°, 80° NE, plane, smooth, closed
5. 72, 9° SE, " , rough, "

345°, 81° NE	irr	rough	closed	
333°, 80° NE	"	"	"	
329°, 90°	curved	"	open 3"	
342°, 84° NE	plane	smooth	closed	
343, 59° NE	"	"	"	
[illegible], 81° NE	"	rough	"	
350, 80° NE	plane	"	"	
76°, 45° SE	irr	smooth	closed	
77°, 15° SE	plane	rough	closed	
55°, 4° SE	irr.	"	open	
345°, 77° NE	plane	"	?	
330°, 84° SW	"	"	closed	
337°, 69° NE	"	"	"	
349°, 74° NE	"	smooth	"	
10°, 4° E	plane	smooth	"	
335°, 80° NE	"	"	"	
338°, 89° NE	"	"	"	
281°, 15° S	irr.	rough	open	
341°, 83° NE	plane	"	closed	
67°, 90° NW	irr	rough	open x 2	
347, 84° NE	plane	smooth	closed	
349, 88° NE	"	"	" 8" x 2	
349, 86° NE	"	rough	closed	
344, 77° NE	irr.	"	open	
343, 84° NE	plane	smooth	closed	

335°, 86° SW	plane	smooth	closed	
44°, 19° SE	plane	rough	closed	
87°, 14° S	irr	rough	"	
345°, 88° NE	"	"	"	
357°, 6° E	plane	"	open	
350°, 85 W	"	"	closed	
348°, 85° NE	"	"	closed	
347°, 87° NE	irr	"	part open	
87°, 90°	curved	"	?	
78°, 88° SE	"	"	Part open	
331°, 21° SW	plain	"	closed	
351°, 76° E	curved	rough	"	
354°, 13° W	plain	"	"	
349, 84° E	"	smooth	"	
346, 85° E	"	"	"	
343°, 84° E	"	"	"	
90°, 18° S	"	rough	"	
103, 18° S	plane	"	open	
77°, 8° SE	irr	"	"	
342°, 76° NE	plane	smooth	closed	
65°, 80° NW	irr	rough	part open	diff face on E-W
70°, 78° NW	"	"	?	
95°, 18° S	curved	"	p. open	
58°, 44° SE	plane	smooth	closed	
345°, 84° NE	"	rough	p. open	

76.	347°,	87° SW	plane,	rough,	closed
77.	55°,	55° SE	curved,	"	"
78.	344°,	70° NE	plane,	"	"
79.	76°,	64° S	curved,	rough,	closed
80.	60°,	55° S	plane,	smooth,	"
81.	330°,	27° SW	curved,	"	"
82.	335°,	70° NE	"	"	"
83.	48°,	8° SE	plane,	"	"
84.	312°,	78° SW	"	"	"
85.	67°,	23° SE	"	"	"
86.	348°,	82° NE	"	"	"
87.	60°,	60° SE	"	"	"
88.	55°,	55° NW	curved,	rough,	open
89.	65°,	30° SE	plane,	smooth,	closed
90.	75°,	50° E	"	rough,	open
91.	60°,	18° E	"	smooth,	closed
92.	50°,	47° NE	curved,	"	"
93.	71°,	88° E	plane,	rough,	open
94.	75°,	73° NW	curved,	smooth,	open
95.	310°,	50° SE	"	"	"
96.	65°,	10° NW	curved,	rough,	open
97.	20°,	30° SW	plane,	"	"
98.	270°,	20° SW	"	smooth,	"
99.	311°,	41° NE	"	"	"
100.	75°,	89° NW	curved,	rough,	closed

101.	75°,	70° NW	plane,	rough,	closed
102.	82°,	70° NW	curved,	"	open
103.	70°,	57° SE	curved,	smooth,	closed
104.	85°,	36° S	plane,	rough,	closed
105.	68°,	40° SE	"	smooth,	"
106.	80°,	67° S	irregular,	rough,	"
107.	65°,	84° NW	plane,	"	"
108.	4°,	15° E	plane,	"	"
109.	350°,	50° E	plane,	smooth,	closed
110.	90°,	15° S	"	"	"
111.	100°,	11° S	"	"	"
112.	96°,	27° S	"	"	"
113.	48°,	06° NW	curved,	rough,	open
114.	65°,	60° NW	plane,	"	"
115.	60°,	8° SE	"	smooth,	closed
116.	84°,	35° SE	curved,	rough,	closed
117.	35°,	13° NW	plane,	smooth,	closed
118.	105°,	70° NE	"	rough,	open
119.	352°,	68° E	curved,	"	"
120.	60°,	76° NW	"	"	"

Outcrop has heavy clayey cover, rock is massive, difficult to determine bedding

Plotted on the redline TS
AT July 18 1981

Natana — Till & AL Sampling

W-80-300

Sampled a sandy till, matrix is a fine sand w/ a trace of till. Some cobbles are striated.

Elev 2226' @ 10^{22} @ 32°

Top of bluff 2311' @ 11^{40}

One big bag & one large plastic [illegible]

W-80-[illegible]

Sampled the silty-clayey till. One large gallon jug, one small jar, & one large cloth bag. From sharp down [illegible] at Deadman, left abutment.

Elev. 2105' @ $11^{[illegible]}$

W-80-301

Revisited the Tins to get a large sample of the rock for thin section, [illegible] of the diorite, Upstream [illegible]

of the fine outcrop

W-80-302
On the Sus River Taking sample of stream alluvium
Sample from 0' to ~ 1' depth
size doesn't change much
Do have boulders on the surface up to 5' in length
Most boulders < 1.5' in diam.
the large cloth bag.

W-80-303
Outside edge of Quarry "A",
275° 78° N spacing 1-2°
north face, rock is heavily jointed
breaks up into small chunks
Missed this last time Rk is poor

W-80-304
Took sample here, it was

the best we could do

Flag of Dam site - Watana

photo 32 →
next roll
1 → 11
} south facing slope d/s to u/s

12-26 North facing slope

Elev. 2281' @ 1:47

Photo Tlogd near 'E' Creek
27-30

Fly of Devil Canyon Dam Site

picture panel - right abutement
bedding is near vertical
* Note beneath center line
intense parallel jointing
~ 330°? ± 15° generally
intense fracture zone

Home!!

Just downstream from Portage Ck
Kag is warped and dips SE ~ 20°
to 30°, less steeply than in
the canyon

10-9-80

Stu and I are going to TKA and the dam sites. Will do a quick review and then look at the drill core here in TKA. Dan is working in the office.

1) Flew over the Talkeetna thrust area on the Susitna
2) Flew Watana dam site
   c/c, buried channel
   shear zone on Tsusena Ck
   borrow site "D"
   till in Deadman
   Borrow site "H"
3) Flew Devil Canyon
   in the canyon

BH-8
191.5 - 192.5' chlorite
46.0 - 47.0' and
sample from Box #4
dropped the box, not
in order

ROD: for the 1A
permeability

BH-4s Box #10
~468' to 469'

Box 13 ~128' to 129'

BH-8

678' to 695' ≥ 90%
695' to 710' ~ 70%

625' to 628' fracture zone
628' to 640' good ≥ 85%

BH-6

692' to 708' fracture zone

708' to 717' good 50%
692' to 680' " "
728' to 735' good 90%

10 v)
1 n.

Contents

WATANA DAM SITE 1-40, 42-51, 100-151

SUSITNA UPSTREAM - 1-40, 42-46, 130-140,

SUSITNA DOWNSTREAM - 47-51, 100-130, 141-151

DEVIL CANYON DAM SITE - 52-78, 91-99

CHEECHAKO CREEK - 79-90

WOODWARD-CLYDE - 41

JOINT MEASUREMENTS - 28-40, 42-46, 63-67 141-151.

75

3-12-81

Arrived at Watana Camp this AM. Will work on the Watana dam site, starting at the u/s sheared area, the Fins. K. White will be working with me.

Photos: 1-4-6
COE mosaic 5 prints.

W-81-1

Working in the eastern most chute in the "Fins". The west facing face is composed of a diorite (CI = 20%, lots of sodic plag., no qtz visible. In places the granitic face of the rock is sheared. Rock breaks into granules, appears to be breaking down along the grain boundries. Half way up the chute, the diorite is in contact with andesite. The contact is sharp. The diorite in contact is breaking down somewhat

Within the divide, is some fine grained schist. Diorite has a lot of biotite.

cliff face

Chute west facing strikes 330°

Minor shears

45° 68° SE max 1"

043 - highly fractured, more weathering

52° 65° SE max 1-1.5"

049 - highly fractured

spacing 1' - 10' from fractures

E shears aver.

Walking up the chute and looking at this west facing face see mostly diorite with some andesite. In places the andesite looks stratified, probably fractures in the andesite filled with felsic (plag) material that was intruded into the andesite or vice versa. The problem is that besides dipping steeply it is subparallel in places. This face may be the edge of the contact zone between the andesite & diorite.

Could be xenoliths, instead of veins.

Walking back down the east facing cliff face, Diorite was at the top with andesite the rest of the way down. Andesite is a green to dark gray rock with xtals of biotite & hornblende up to 1/4" in diam.

? Highly fractured zone:

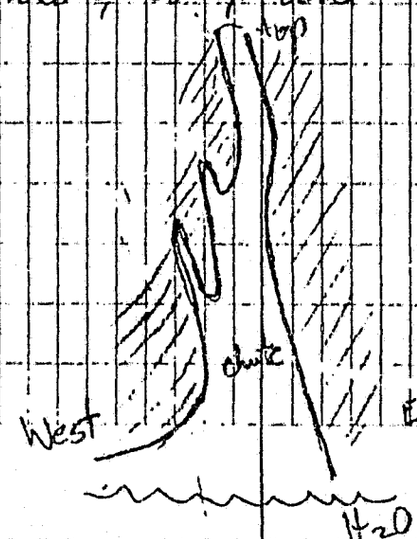
65° 85° S 1" x 6" spacing

062 - good andesite, not sheared

rock is competent

- elev (helo) ~

Diorite is a medium grained rock. May have quartz diorite at the top of the east facing face of the chute. Though I could see quartz. Rock is hard & competent.



Didn't see any evidence of shearing in the east facing cliff face at the top of our traverse. It doesn't project up the slope & intersect that cliff face.

Could this be the area where the andesite came up through the diorite & flowed out at the surface? Idea to think about after going over this area thoroughly.

In one area where the andesite was in contact with the diorite, the andesite has that layered appearance. Interfingering or veins in the transition zone. Not sure how this "layering" feature fits in.

[#7, p2-4]

3-13-81

It's currently cloudy & approx 20° (7:30). Will work on the right abutement at the Fins today.

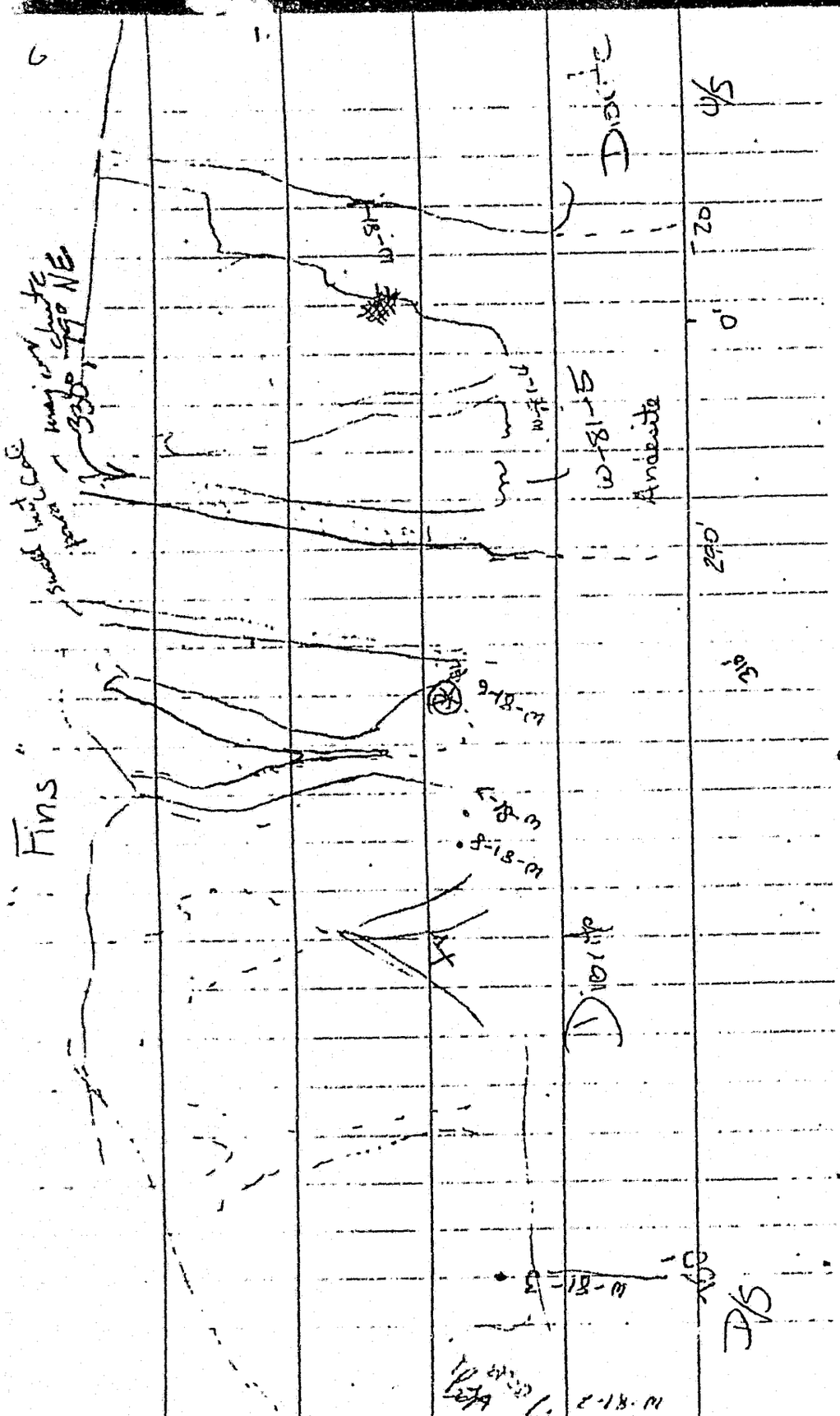
Photos: 1-4-6, 1-6-8
COE Photo Mosaic

W-81-2 [#7, 5)

Good competent medium grained diorite (possibly qtz diorite). It's a little oxidized, and outcrop is hard

Joints	292 295°	67° NE	Spacing 1-2' ave
	305° 302	60° NE	
major	335° 332	73° NE	Spacing 2-3'
Minor	350° 347	20° E	spacing 2-3'

Jointing only dominant on d/s face, the rest of the outcrop is characterized


Fins
Andesite
Andesite
U/S
D/S
W-81-3
W-81-2
W-81-1
W-81-6
W-81-5
W-81-4
W-81-7
W-81-8
W-81-9
W-81-10
W-81-11
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W-81-38
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W-81-40
W-81-41
W-81-42
W-81-43
W-81-44
W-81-45
W-81-46

* Andesite Dike in the diorite is approx 330' wide.

W-81-4 [#7,6]

At 120'-175' joint measurements taken in the andesite porphory. Andesite is a gray green with small white plag. phenocrysts and contains large (up to 1/4") hornblende xtals. Joint surfaces are plane rough & pitted. Four minor shears here of crushed rock which is oxidized. They range from 1/4" - 6" and are parallel to the major joint trend.

310° 307-322

major ~~295°~~ - 325° (4) dips 63°-75° NE ✓

minor 295° - 297° (2) dip 45°-54° SW ✓

292 294 50

Two joint sets give blocky texture

Spacings are 1-2'

K.W. photo ✓

probable block? at river level #6

W-81-5 andesite porphory with a med. gr. inclusion of diorite — oxidized, sharp contact, hard.

Joints just west of 81-4 are sub-

[#7,7]

0° 357	23° W		N-S
357° 354	30°	W	
347° 344	15°	W	
40° 37	15°	NW	NE
297° 294	12°	SW	NW
0° 357	25°	W	
285° 282	2°	N	EW
55° 52	15°	NW	NE

355 / 25 W

45 / 15 NW

horizontal with many orientations

These joints are plane & rough

The subhorizontal sets and the major set

315° 312 85° SW

313 / 86 ✓

Major	315° 312	85° NE	spacing over 1-2'
	305° 302	80° NE	
	320° 317	87° NE	

produce a blocky texture. Subhorizontal joints are prominent at river level

~175' - 260'

Major chute 330°, 79° NE

W-81-6 ~325' [#7,7]

At 1980' locale for joint measurements

In walking east, just passed back onto the red gr. diorite. It is hard concrete and has little thin stringers of andesite which revealed the small fractures in the rock. There is a shear zone here with slickensides. Crushed, pulverized rock ranges from 4-6" thick. The oxidized & weathered zone average 1' wide. Some calcite on sides of this shear zone w/slicks

Strike of shear
35° 2° 57° W ✓

two shears ~20' apart
11 J
see photos (LOE)

Dip of slicks
64° S

Some of the joints are filled with calcite up to 3/8".

Diorite w/ stringers of andesite is close to the contact with the andesite.

The shear material is sandy mostly

The Diorite is hard & unweathered about 1.5-2' away from the shear

Major JOINT SET
320° 70° SW spacing 2'-4' ✓
317

Walking up the chute adjacent to, 81-6 Still in diorite. Have another shear ~2' wide
35° @~1700'
357° 88° W, appears ✓
to be crushed pulverized material. There were several other <2' zones approx. parallel to the one above. They were at least highly oxidized & weathered. Whether they had the crushed, pulverized material is uncertain. These zones match up with notches in rib to the west. Could possible match up with ones on the left abutment and therefore pass under the u/s cofferdam.

W-81-7 @ ~450' Shear zone up to 18" wide, in the diorite. The diorite on either side is heavily oxidized and sound.

Shear Orientation

[#7, 8] @ 325° 67° NE ✓
322

and weathered

Shears - mostly crushed rock, but some clay size material in both

(b) 290° 88° N 8-10" wide ✓
287

W-81-8

Shear in the diorite at ~460'. The rock is highly fractured with a crushed zone ~2" wide. Fractured zone is ~18" wide. Rock adjacent to is highly oxidized & sound.

337 338° 84° NE ✓

Some of these shears have approx the same orientation & therefore may line up.

At approx 625' there are a few steeply dipping narrow dikes (2-3') Aplitic

W-81-9

In walking downstream along the river on the right abutement the rock is generally a hard, sound, med gr. diorite with only one small shear passing through this zone.

Shear is 330° 82° SW over ✓
~2" wide zone of gouge - silt & sand size particles orange brn in color. Diorite is sound on either side

Moved over to the left abutement opposite the "Fino". No outcrops along the river from the last diorite outcrop around the bend d/s to here.

W-81-10 [#7,9]

Beginning of outcrop which extends u/s. Is a green porphyritic andesite with large (1/4" diam) plagioclase phenocrysts. The andesite is a green gray color, generally hard but fractured heavily on the d/s end, becoming less ~50' u/s.

Prominent joints

#7	350°	40° W	6"-1'	✓
#27	330°	71° SW	1'-2'	✓

Just u/s is a large chute ave ~10' wide which is snow covered trends ~315°. Rock is heavily fractured on the d/s edge

W-81-11 [#7,9]

Gray porphyritic andesite, zone is highly fractured. Rock is still fairly competent, but it is fractured in hand size pieces. The sense of direction for this fractured zone is difficult to determine. The outer surface is stained with a pale yellow but mostly chalky white

W-81-12

Gray andesite porphyry. Large white phenocrysts of plagioclase and hornblende sticks some needle shape.

Between here & 81-11 there are small inclusions of fine grained material up to 6" in diameter. At this locale there are two severe inclusions of diorite with one 2' in diameter.

There is a small 1" fracture or possible shear zone

@ 5° 75° W

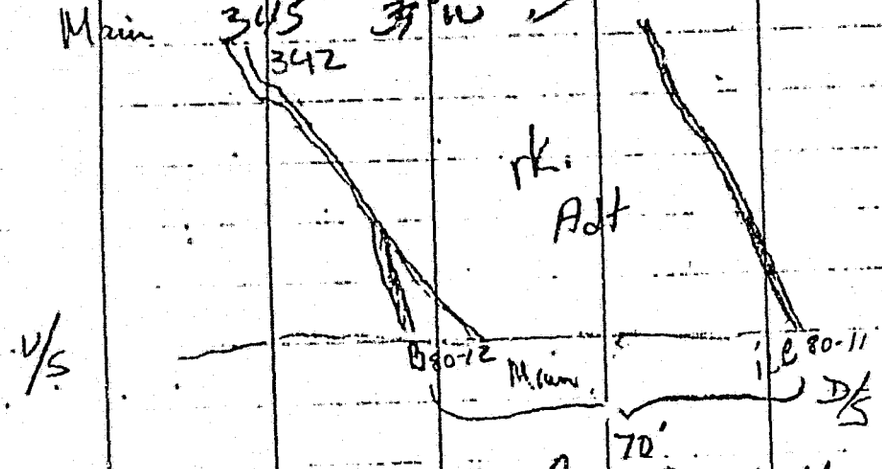
The contact between the andesite & the diorite & fine grained material is sharp

The inclusions increase in number from 81-11 to 81-12

Branch 357° 354 76° W

Main 345 39° W ✓

6' d/s ✓



Branch is ~ 18" wide and is highly fractured sound rock.

- Branch

Main aver. 2"

Branch is parallel to the other previous one. ~ 70' spacing

Some inclusion (small) of plagioclase w/ needle shaped hornblende xtals

TOD - A large dike of andesite cuts threw the Fins. This also appears to coincide with the knob on the left abutement. While have to delineate its limits on the left abutement. Also can we pick it up on Tsusena Creek. Can be a large dike or a fissure, from which the andesite flowed out. Don't think it could be the source chamber here but don't rule out for other areas, i.e. Fingerbuster area?

Secondary shears ~ to the principal shears, may pass beneath the area of the U/S cofferdam & intersect the left abutement, check in spring. On the river just downstream of the Fins, didn't see any of these shears intersecting the rock, but one. And it is parallel to the major shears.

The major face on the U/S end of the knob should coincide with a joint set, the andesite/diorite contact, or possibly a shear

13-23 up next page

3-14-81

7:30

It's mostly cloudy & approx 22°
Start working at the knob opposite the
Fins and will continue upstream.

Photos: 1-6-8 ; 1-6-5

Face of the cliff is 289 292° dips 88° S

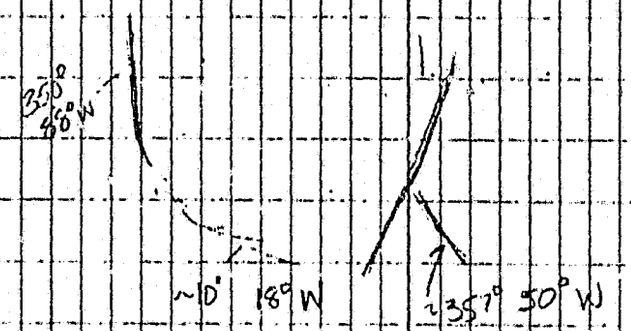
W-81-13 andesite porphory

312-317 315°-320°	83° SW	Major 315
02 5°	18° W	one, but prominent
02 35°	77° SW	Minor

rock is spalling off in small chunks along this face. Some pods of feldspar with needle shaped hornblende xtals up to 1/2" long - more plentiful here

Chute in knob may be due to the ~290° & 45° joint sets, except a little more intense fracturing. Check the top latter.

Andesite porphory w/ some diorite w/i, sharp contact



Joints

02 5°	74° E	1'-3'
02 5°	82° E	
83 86°	85° S	

Joint

354 357° 34-36° W 8'-1'

exposed and prominent at river level.
small xenoliths of argillaceous mat'l

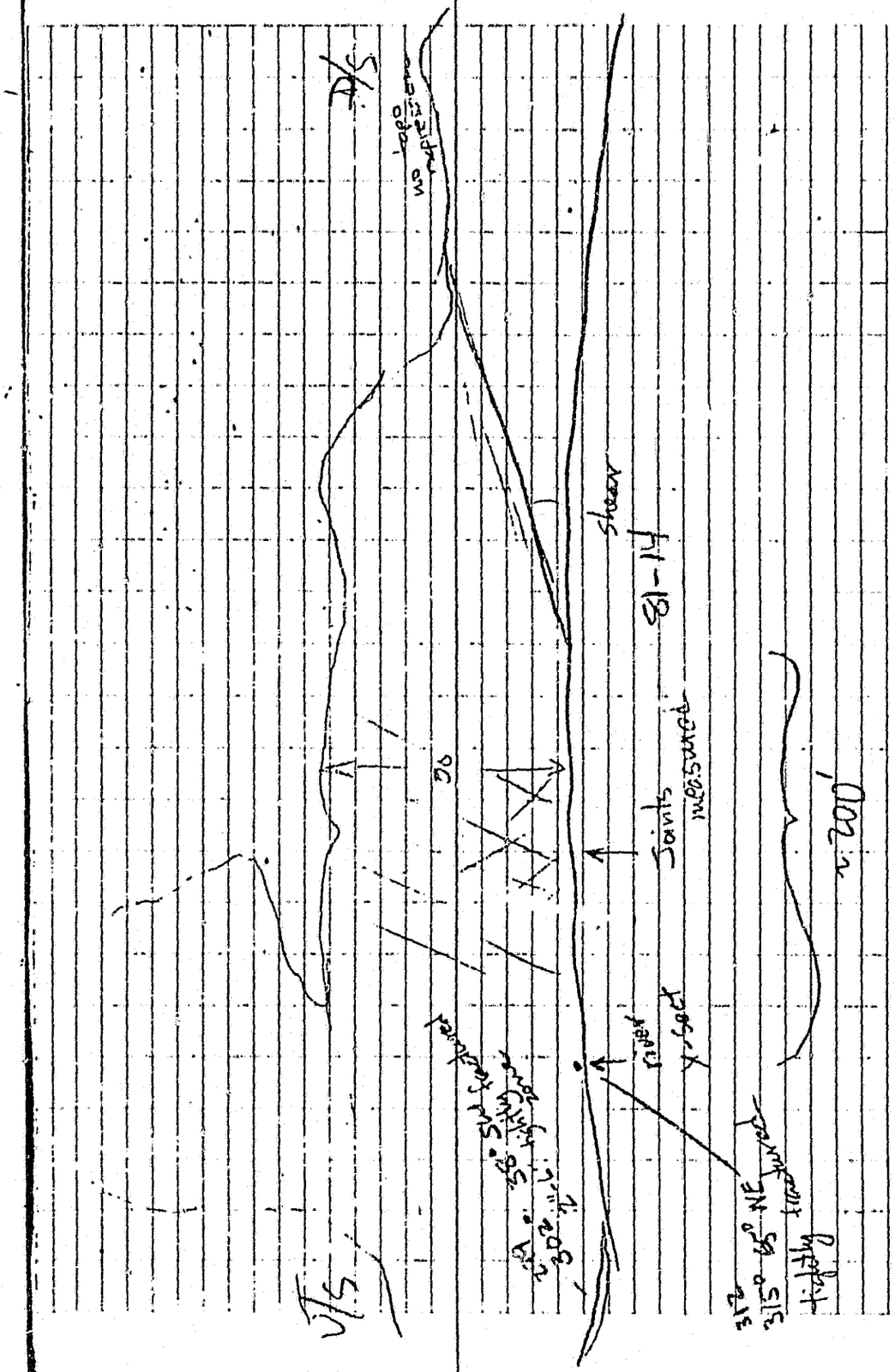
[illegible] 20° S

W-81-14 [#7,11]
Shear zone, covered by vegetation line on the cliff face. Characterized
2 dim dip 13°
by shattered rock. Still andesite porphyry. Cliff approx. 30' high.

Orientation
58 61° 20° SE
Shear is zone of fractured rock up to 6"-1' thick. Also some crushed rock (sand size), up 2-4" thick.

Joints

07	10°	67° E	aver. 4'
345	348°	82° W	1-2'
84	87°	60° S	1-2'
295	298°	50° N	aver 2' range 1-4'



Walking upstream saw some diorite, but eventually passed into argillaceous material

W-81-15

Outcrop, large, of argillaceous material. Finely laminated bedding of clean fine gr. sands & muds. Bedding is on end. Beds are on end and is characterized by shaly weathering oxidized, moderately weathered

Bedding

45° vertical

faces NW

36° NE Boudin-type structure

Beds on end

Joints: 307

main	310°	66°	NE	spacing 6"
	0° 357	15°	W	6" to 1'
	135° 132	63°	S	1", discontinuous

Little fault W/-

52 55° 85° NW

not as finely laminated

The argillite contains some med gr. biotite dikes ~6' wide

W-81-16

Diorite outcrop, heavily oxidized & fractured. Diorite is medium grained. Outcrop is badly broken up, ~20' high and 40' long

W-81-17

large outcrop of the med. gr. diorite biotite rich. Mostly sodic plagio clase. Outcrop is at least 70' high

Joints - major

342° 84° SE range 6" to 3'

33° smooth, plane

Horizontal set

95° 83° N 1' to 2'
92

W-81-18

Contact between argillite & diorite bearing approx 320° & dips ~ 62° NE. Contact appears sharp, diorite is still medium grained. Argillite is hard as it has been baked. Argillite is either part of the main body or 100' pendant. Contact is on d/s side of the chute. Argillite has little drag folds with axial plane cleavage

W-81-19

More argillite in walking downstream. Not sure if its connected to the other block. Could be a fold. Argillite

Strike 277 280 78° SW

is finely laminated

W-81-20

Outcrop of andesite porphyry ~ 200' above the river on the knob. Near the d/s end of outcrops on the knob.

Another 10' upslope find the contact between the andesite porphyry and the diorite. Andesite porphyry has a green groundmass with large phenocrysts of plagioclase & small mafic stals. Diorite is medium grained

Joints:

52 55° 57° SE 6"-1' discontinuous

31 312 64° NE

355° 352 80° W 6"-1' aver.

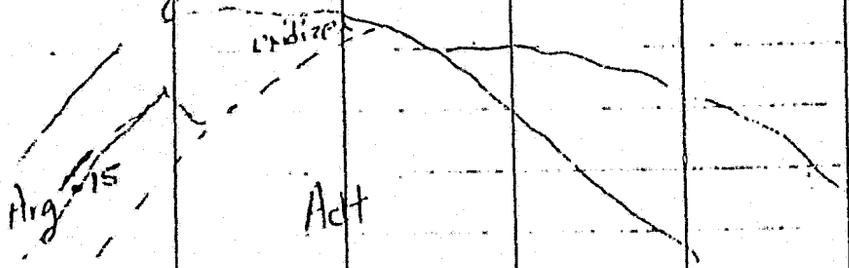
Going higher up the slope & d/s didn't see any more outcrops of diorite, only andesite porphyry

W-81-21

Large outcrop of andesite porphyry near the top of the knob. Contains white

W-8-[illegible]

Just downstream from this site
Argillite is in contact with the andesite,



pb Andesite is a green gray fine grained rock which contains some fine laminated argillite blocks and diorite material. Contact may follow the strike of the argillite beds. Andesite is not a porphory.

W-8-21 Diorite

Large outcrop of andesite porphory near the top of the knob. Contains

Joints:

357	0°	77° W	1'-2' ✓
02	5°	6° E	1'-2' ✓
321	330	56° SW	6" do
317	320°	vert.	

white phenocrysts up to 1/4" and small mafic minerals (hornblende?). There are a few small inclusions of diorite. Rock is hard, fresh.
Sample taken.

In walking the knob in the u/s direction, only saw andesite porphory.

W-81-22

Top of gully on the u/s side of the knob. Outcrop of andesite porphory. Chute

Joints

315°	312	36° SW	spacing 1'
50°	47	54° SE	aver 1' irregular surface
345°	342	65° SW	~3'
355°	352	86° E	1'-2'

is filled with talus rubble. Rock is hard, fresh.

W-81-23 ?

In the saddle area of knob. Found some diorite may be float rock though It forms a little ridge that is covered by vegetation. The rock is highly fractured and oxidized. Flagged

Checked contact of Drt/Adt in the Fins structure & corresponds to major chute at river level

WJ-5 on map

* Joint Measurements in the possible diversion tunnel area, W-81-3. All joints are tight

1.	83	86°	79° N
2.	333	336°	70° SW
3.	6	9°	25° E
4.	38	41°	79° NW
5.	330	333°	73° NE
6.	82	85°	83° S
7.	287	290°	72° SW
8.	329	332°	78° SW
9.	75	78°	63° N
10.	35	38°	vert.
11.	30	33°	82° NW
12.	335	338°	52° NE
13.	317	320°	53° SW
14.	287	290°	83° SW
15.	33	36°	82° NW
16.	30	33°	81° NW
17.	269	272°	vert.
18.	75	78°	88° S
19.	87	90°	52° S
20.	10	13°	55° E
21.	312	315°	84° NE
22.	320	323°	87° NE
23.	44	47°	85° NW
24.	46	49°	85° NW
25.	46	49°	85° NW
26.	292	295°	80° NE
27.	50	53°	87° NW
28.	87	90°	14° N
29.	292	295°	85° SW
30.	302	305°	75° NE
31.	12	15°	44° E
32.	38	41°	83° NW
33.	38	41°	78° NW
34.	328	331°	71° NE
35.	47	50°	81° NW
36.	0	0°	38° E

Plotted 3-15-81 JPB

* Grouped readings marked in red

37.	27 30°	55° SE	
38	38 41°	75° NW	
39.	328 331°	82° SW	
40	317 320°	74° NE	
41.	300 303°	73° NE	
42	306 309°	73° NE	
43.	69 72°	64° SE	
44.	315 318°	72° NE	
45	309 312°	vert.	
46.	45 48°	vert.	
47.	77 80°	14° N	
48	278 281°	80° S	
49.	80 83°	74° S	
50	75 78°	84° S	
51.	47 50°	74° NW	
52.	0 0°	53° E	
53	40 43°	74° NW	
54	32 35°	82° NW	
55	345 348°	20° NE	
56.	31 34°	83° NW	
57.	49 52°	70° NW	
58.	39 42°	82° NW	
59.	309 312°	vert ~~NE~~	
60.	317 320°	vert.	
61.	262 265°	12° N	

* Corrected readings marked in red.

62.	67 70°	66° S	
63.	301 304°	70° NE	
64.	44 47°	85° NW	
65.	314 317°	79° NE	
66.	295 298°	26° NE	
67.	302 305°	40° NE	
68.	297 300°	83° N	
69.	62 65°	46° SE	
70.	22 25°	15° W	✓
71.	322 325°	66° NE	
72.	71 74°	61° S	
73.	27 30°	88° NW	
74.	35 38°	8° SE	
75.	304 307°	76° NE	
76.	2 5°	56° W	
77.	327 330°	64° NE	11 to shear
78.	53 56°	63° SE	
79.	347 350°	83° W	
80	55 58°	78° NW	
81.	285 288°	55° S	
82	55 58°	83° NW	
83.	341 344°	78° SW	
84	40 43°	65° NW	
85.	7 10°	9° E	
86.	315 318°	54° NE	

87	321 324°	64° SW	
88.	272 275°	75° S	small shear
89.	41 44°	57° NW	
90.	32 35°	59° NW	
91	28 31°	61° NW	
92.	325 328°	41° NE	
93.	320 323°	80° NE	
94.	275 278°	75° S	small shear 3"
95.	320 323°	72° NE	
96.	342 345°	63° W	
97.	50 53°	vert.	
98.	257 260°	37° N	
99	35 38°	78° NW	curved
100.	9 12°	21° E	

measurements over 60'

Plotted on the red sheet TS 87 July 1, 1987

Spacing

Major ?

71, 45° steep dip 6"-2'
42 plane, smooth, tight generally open near river, some Carbonate

I 315°-330° steep, 1'-2' range
312-327 plane, irregular } tight

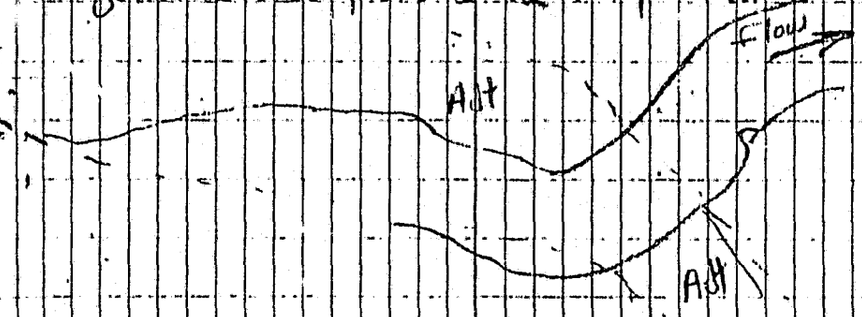
~E W shallow dip N, aver. 1', variable 6"-2'; smooth, irregular, tight

65-75° dips S, 2'-4' plane, s. irregular, some calcite, tight

* Correction cardinals marked in red

TOD - Most of the knob on the left abutement consists of the andesite porphory. Working our way U/S, found some argillite in contact with the andesite. Argillite is probably a roof pendent or remnant. The andesite bordered on both sides by the argillite is a fine grained green-gray or gray-green color. It is not a porphory and therefore it may be a different episode.

Joints were quite variable in the rock along this cliff face. They may make it difficult to compare joint orientations with other areas & thus eliminating the idea of a slide block. Compare the joint stereo plots when completed.



Andesite texture is different on each side of the river.

Could there be more than one episode of andesite at Watana. There is the flow which is exposed on Quarry A, 3H-8, & d/s of the site. Then there is the andesite porphyry exposed at the knob.

3-15-81

It's mostly clear this A.M. and it is approximately 12°. Will finish working on the joint measurements at W-81-3 and then will proceed to do measurements at the Fins and knob. This afternoon will get the sample for W.C.C.

Photos: 1-6-8 ; Color 2-6-8

✓ on map
WJ-6

W-81-5 and moving towards 81-4

* Stat 2+60 to

plotted 3-18-81 MPB

1.	322	325°	81 NE
2.	322	325°	88 NE
3.	305	308°	7 NE
4.	0	3°	23 W
5.	29	32°	21 NW
6.	342	345	26 SW

* CORRECTED STRIKES MAPPED IN Red.

	77			
7.	80°	25 N		
8.	12 15°	23 W		
9.	334 337°	73 SW		
10.	330 334°	78 SW		
11.	35 38°	81 SE		
12.	80 83°	86 N		
13	87 90	88 S		
14	320 323	86 NE		
15.	67 70	46 S		
16.	346 344	49 SW		
17.	304 307	78 NE		
18.	84 87	13 N		
19.	318 321	77 NE	$CaCO_3$	
20.	300 303	85 NE		
21.	59 62	36 NW		
22.	317 320	81 SW		
23.	272 275	19 N	$CaCO_3$	
24.	18 21	65 W		
25.	338 341	70 SW		
26	44 47	37 NW		
27	322 325	90?		
28	354 357	62 W		
29	72 75	15 N		
30	310 313	78 NE	$CaCO_3$	
31	309 312	83 NE		

32	294	11 N	
33	332	80 SW	
34	315	79 NE	
35	57	7 SE	
36	241	9 SW	
37	72	4 N	
38	62	19 NW	
39	28	84 SE	
40	318	81 NE	
41	328	80 NE	
42	45	12 NW	
43	335	63 NE	
44	320	73 NE	
45	52	8 NW	
46	46	20 SE	
47	292	89 SW	
48	332	64 NE	
49	305	35 SW	
50	332	89 NE	
51	294	84 N	
52	292	22 S	
53	17	35 E	
54	336	89 SW	
	0	3 W	
56	328	23 NE	

#			
57	327 330	25	SW
58	307 310	57	SW
59	320 323	40	SW
60	333 336	80	SW
61	334 337	82	SW
62	310 313	84	SW
63	60 63	37	SE
64	70 73	40	N
65	39 42	37	SE
66	347 350	73	W
67	297 300	37	NE
68	303 306	31	SW
69	0 2	22	W
70	319 322	35	SW
71	36 39	14	NW
72	45 48	60	SE
73	323 326	85	NE
74	53 56	13	NW
75	313 316	84	SW
76	282 285	39	S
77	312 315	85	SW
78	84 87	66	S
79	344 347	63	W
80	322 325	87	NE
81	332 335	87	SW
82	315 318	60	NE
83	269 272	50	S
84	317 320	86	NE
85	312 315	78	NE
86	49 52	38	NW
87	80 83	5	S
88	328 331	89	NE
89	64 67	13	SE
90	332 335	79	SW
91	311 314	90	
92	339 342	16	SW
93	24 27	8	NW
94	306 309	10	SW
95	72 75	37	S
96	283 286	58	S
97	316 319	80	NE CoCO3
98	347 350	75	W
99	279 282	22	S
100	322 325	64	NE

End at Station 2+05

Major Joint

Set I
- NW trend steep dip SW
- Spacing 6" - 3 ft av 18"
- Planar, smooth, tight
- NW trend steep dip NE
- Spacing 1-2 ft, planar, smooth, tight, CoCO3

Plotted on Redlinetic June 26th 1989 TS

*Corrected strikes marked in red

* Joint measurements taken at the knob on the right abutement, just downstream of 81-12. Wanted to get a good x-sect. at 81-11 but there are to many small fractures. Face of cliff is 283° & did measurements for ~50'

CW-7

1.	68 71°	80° N	
2.	343 346°	55° SW	all the way through outcrop.
3.	0 3°	50° W	
4.	67 70°	vert.	
5	22 25°	27° NW	
6.	307 310°	78° NE	
7.	325 328°	82° NE	
8.	338 333°	88° SW	
9.	65 68°	72° NW	
10.	312 315°	52° NE	
11.	72 75°	83° S	
12.	17 20°	19° E	
13.	279 282°	85° N	wavy joint
14.	329 330°	wavy joint subhorizontal	→ NOT Inc. Included in Joint plotting
15.	69 72°	77° N	
16	284 287°	69° N	
17.	291 299°	56° NE	
18.	354 357°	35° W	
19.	14 7°	12° W	

on road

* Corrected strikes marked in red

20.	19 22°	23° W	
21.	14 17°	50° E	
22	26 29°	16° NW	
23.	62 65°	83° N	
24	342 345°	55° SW	
25.	0 3°	38° W	
26.	55 58°	52° SE	
27.	297 300°	56° NE	
28.	282 285°	67° NE	
29	309 312°	175° SW	
30.	347 350°	44° W	
31.	347 350°	60° W	
32.	267 270°	84° N	
33	267 270°	77° N	
34	342 345°	73° W	
35	337 340°	84° NE	
36	347 350°	55° W	
37	49 52°	43° SE	$CaCO_3$
38	323 326°	82° SW	
39	326 329°	69° SW	
40.	66 68°	vert.	
41	87 90°	40° N	
42.	352 355°	37° E	
43	292 295°	75° N	
44.	285 288°	75° N	

	283°	~50'	
45.	0 0°	48° E	
46.	0 2°	51° W	
47.	343 346°	61° SW	$CaCO_3$
48.	293 296°	21° N	$CaCO_3$
49.	81 89°	70° N	
50	0 30	58° E	
51.	312 315°	81° NE	
52.	37 40°	42° SE	
53.	1 4°	55° W	
54.	49 52°	57° SE	
55.	343 346°	60° SW	
56.	349 352°	52° W	
57.	42 45°	62° SE	
58.	335 338°	72° SW	
59.	337 340°	78° SW	
60.	72 75	60 NW	
61.	69 72°	65° N	
62.	287 290°	80° S	
63.	340 343°	69° SW	
64.	336 339°	78° SW	
65.	68 71°	63° N	
66.	350 353°	18° E	
67.	348 351°	60° W	
68.	292 295°	vert.	
69.	305 308°	84° SW	

70.	65 68°	vert.	
71.	297 300°	74° NE	
72.	55 58°	vert.	
73.	62 65°	vert.	
74.	60 63°	9° NW	
75.	7 10°	65° W	
76.	74 77°	78° S	
77.	335 338°	84° NE	
78.	24 27°	72° SE	
79.	351 354°	65° W	
80.	40 43°	59° SE	stopped, finish 3-16
81.	316 319°	43° NE	
82.	349 352°	64° W	
83.	224 227°	62° NW	
84.	319 322°	17° NE	
85.	24 27°	20° W	
86.	344 347°	63° SW	
87.	42 45°	82° SE	
88.	50 53°	83° SE	
89.	301 304°	72° SW	
90.	304 307°	72° SW	
91.	57 60°	87° SE	
92.	344 347°	84° NE	
93.	55 58°	82° SE	
94.	342 345°	80° E	

95.	303 306°	12° E	aver. 6"
96.	297 300°	13° NE	
97.	304 307°	23° NE	
98.	307 310°	85° SW	
99.	313 316°	70° NE	
100.	15 18°	64° W	

Plotted on Red Sheet TS 01 June 26, 1981

Because of the orientation of the face, should not have as many joints in the 310°-330° range. One should take notice in interpreting the stereo plots, ie. concentrations may be less.

~210° - 60° 6" - 1'
dipping steeply south, smooth, $CaCO_3$, plane

300° - 307° aver 6", sub horizontal plane, smooth

I 310° dipping steeply, 2"-6" & possibly variable; plane & smooth

~0° steep dip, ~6"

II ~60° - 70° steep dip, 6"-1'
irregular, rough, $CaCO_3$

Concl: Joint Measurements at the knob may be rotated, 10°-20° clockwise when compared to the 'Fins'.

3-16-81

It's partly sunny this morning with thin, patchy cloud cover, at 2°. Landed on the left abutement across from the Fingerbuster. General reconnaissance this AM

Photo: 1-4-5

Walked along the base of the cliff across from the Fingerbuster (left abutement). Find both diorite and andesite. It will be confusing when mapping at first because there is no clear cut difference in texture in the rock. Will have to make sure we are consistent. Crossed over to right abutement and began walking d/s. Saw andesite with fine grained inclusions & diorite. Fine grained material is oriented giving the andesite a flow structure. Saw numerous small shears.

N Trend low angle to NW
Spacing 6" - 3 ft, irreg spacing
Planar to curved surfaces
irregular, tight

Lack of joints striking 45° N steep dip station W-81-4 is parallel to 45° but should have picked it up on W-81-5 face, it didn't.

From station 1+25 upstream the following joints become more prominent

335	61	SW
321	67	NE

there are near fracture/shear zone at sta 1+25
Fracture oriented 300°/40°N

NE trend which dips steeply is not apparent here as in the previous measurements. Don't exist.

This afternoon will fly to Watana Creek to get WCC's sample

WCC-1

Stopped at sheared outcrop of andesite or andesite basalt. It's the same one visited with WCC last year. The outcrop is highly fractured and weathered. The large shear which cuts the outcrop is oriented 350° and dips 46° W. It is ≈ 1' wide. Based on the Tertiary volcanics which I have seen downstream, this rock is probably Triassic in age as it is very hard. Between approximately 5000' downstream (knob) where the rocks are argillite to opposite the mouth of Watana Creek, the rock is highly fractured & weathered. No really sound rock specimens can be obtained from this area.

WCC-2 Samples taken here. It's the best outcrop which we could find.

Base line set up on right abutment just d/s of BH-2 on the river. One base line is 0+00 to 7+50 feet at 255° and the other is 7+50 to 8+50 at 255°. This cliff exposure should intersect all major joints and shears at 310° to 320°

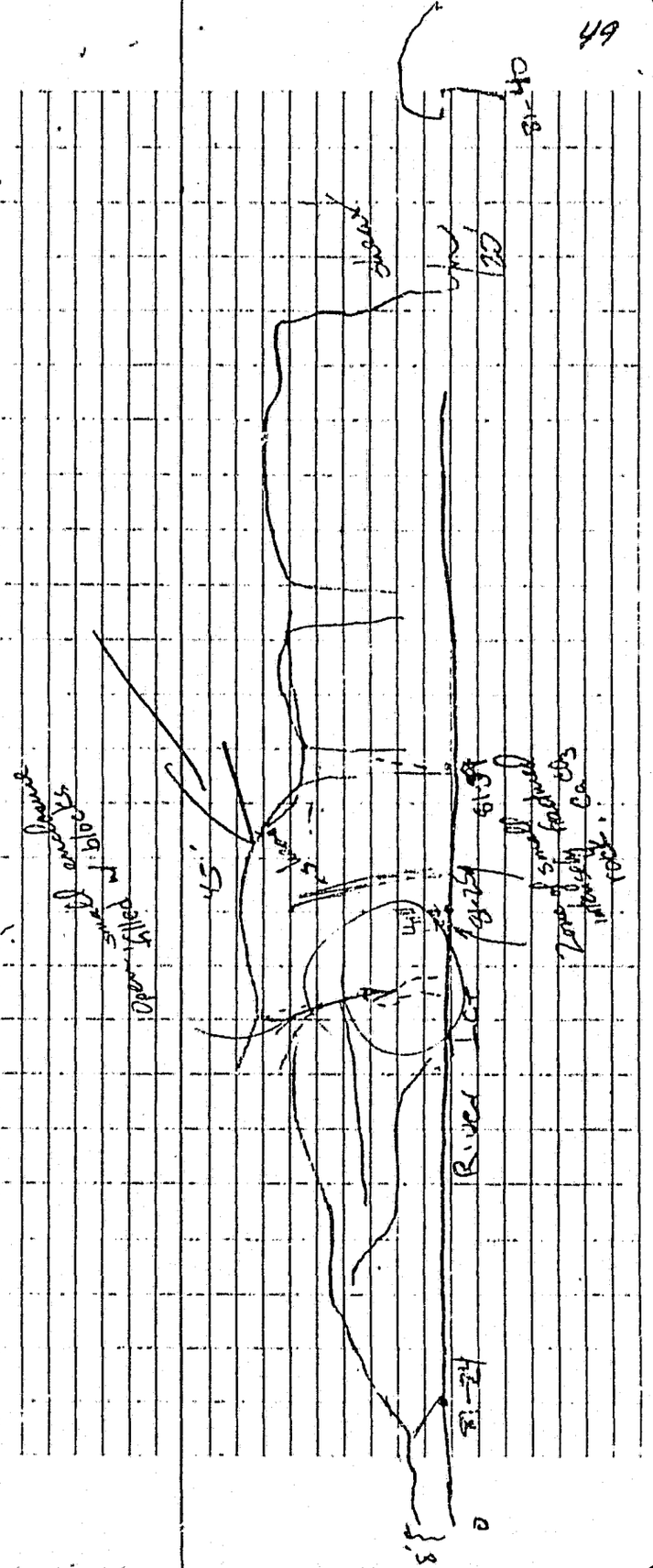
W-81-24 ~50' on base line [#7,15]

In the green porphyritic andesite with inclusions of diorite. Lots of inclusions of the med. gr. diorite = here fair amount of calc-plagioclase here. Number of inclusions are probably ≥ volume of andesite. Sharp contact on inclusions, aver. 4" – 6". Some are larger, rounded to angular.

Joints 30'-65' on base line

major ones	42° 39	22° SE, all the way through outcrop	✓
	47° 34	52° E	✓
	283° 28	83° S several feet	✓
	24° 21	19° SE 6" to 1'	

Rock is hard, slightly weathered


River
45'
Dark Hill
Hill
Dark Hill
Dark Hill
Dark

* From ~ 1+30 on, can see good flow structure in the andesite. Have a thin fracture zone, could possibly call a shear.

17° 17° E, vegetation growing along, wavy

W-81+25 1+75 to 2+50

Light green porporitic andesite, lies to no diorite inclusions, only a dark gray fine grained material for inclusions. Some may be argillite others are just fine grained igneous material. Flow seems to be oriented ~349° 15° W, but mostly variable between 310° - 350° with a dip of up to 15° to the W or SW

Joints:

80° 77 82° N 6"-1'

(297° 294 84° NE 6"-2' aver 1') ✓

(299° 296 87° SW - $CaCO_3$ ✓

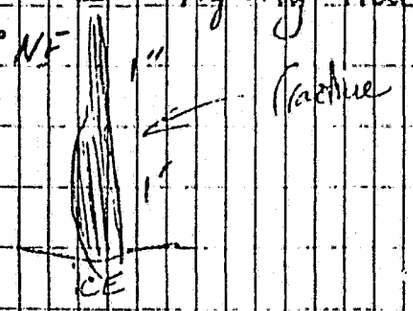
89° 86 85° N.

312° 309 3° SW orientation is variable, aver 6"-1', up to 3'?

2+25 → 302° 299 78° NE small shear of fractured rock 2" to 1'

2+25 309° 306 85° NE tightly fractured

302° 299 85° NE



TOD - Began the day with working on the right abutement next to the 'Fingerbuster'. There are a few small shears which intersect this outcrop. Major chutes are up in the rock outcrop above the river, these chutes do not extend down to river level as at the 'Fins'. Joint sets at the Fingerbuster probably coincide with those at the 'Fins'.

Surveyed Devil Canyon in the P.M. The first 1000' - 1400' from the mouth of the canyon does not look good for traversing. We will be able to work the stretch from approx 2000' to 4500' for sure unless the ice breaks up. Could even work further d/s if needed. May work down a chute on the right abutement if we can figure how to get down there. Cheechako Creek looks day.

3-17-81

It's a cloudy day, temperature is in the 20's but it's very windy, gusting to 30 mph. Jim & I will begin working in Devil Canyon, Ken will work at Watson

D-81-1 charcoal

Dark gray argillite, homogeneous. Slight to moderate weathering. Fractured outcrop, breaks easily along bedding, lacking cleavage; breaking into platy slabs. Rock is slightly phyllitic, to a phyllite in places. Some arsenopyrite

Bedding

Major *	49°	60° SE	planar, slightly curved surface
	50°	56° SE	

spacing 1"-1.5' aver. 8" to 1'

Some chalky weathering

Joints

	7°	37° W	6" to 1'
	352°	57° W	
Major *	340°	87° NE	
	314°	62° NE	6" to 1'
	355°	vert	
	92°	76° N	
	54°	15° SE	1', variable
*	336°	31° SW	1' to 2'
	61°	56° NW	

Joints are generally plane, smooth

D-81-2 flagged inverse of location

At the base of a chute which we will walk up.

Bedding

	63°	51° SE	inches to 1'
Major	67°	47° SE	aver. 4"

plane, rough

Joints

345°	85°	E	
350	88°	E	6" to 1'
345	82°	NE	
38°	33°	NW	
56°	85°	NW	1' to several feet
20°	81°	E	
75°	44°	NW	spacing appears to be on the order of several feet, immediate outcrop covered u/stream
12°	84°	SE	

Heading up the chute, orientation ~ 335°

~ 200' oxidized

303°	57°	NE	6" to 1' curved, irregular rough
300°	64°	NE	
302°	71°	NE	
318°	63	NE	
345°	64°	SW	
47°	54°	SE°	bedding 1" to 1'

Rhyolitic dike

~ 250' up the chute, left side has a glassy dike material while the right or east side has argillite.

A light gray aphanitic groundmass with little smoky quartz xtals, also appears to have some biotite xtals, xtal size ~ 1/16". The dike material is not oxidized like others viewed in the canyon walls. Maximum width of dike is 45'-50' but probably less.

Dike is heavily fractured, average size of chunks 3".

Argillite on right bank is no more fractured than in other locals

45°	62° NW	6" to 1.5' aver. 1'
65	75° NW	
72°	42° NW	

350' - 400' up

Contact between the dike material and argillite on the east side of chute, On the east side ~4' width of the dike material is exposed, it is a dark red weathered rock. Slightly different in texture and color than the dike material on the west side. The contact on east side is sharp

350° 70° SE 100' above subparallel bedding

Strike of Dike 345' 85° S lower

Has 2" dark gray crushed rock gouge particles up to 1/4" Jt. may be parallel to bedding.

Dark red rock may be baked & sheared argillite, fractured like the buff. light gray material

At base of chute, dike appears to be ≤ 15' wide

GULLY DETAILS (~ 300' ABOVE RIVER EAST CONTACT

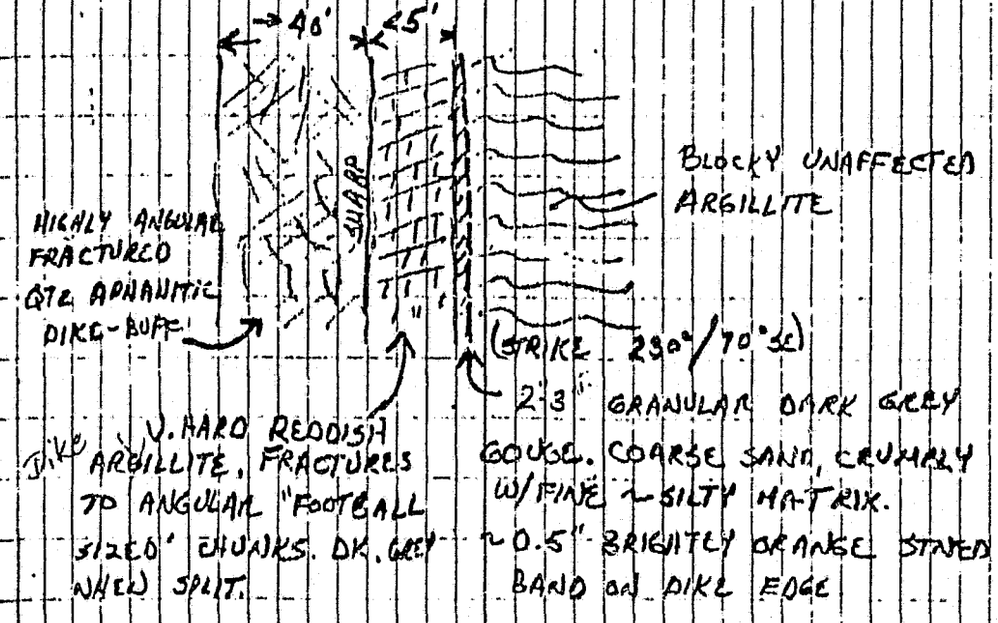


Photo Roll #1

#1	picture of chute at D-81-2
2	looking d/s
3	looking u/s from D-81-1
4	" d/s " "
5	dike on left abutement

250° 60° SW

D-81-3

Dark gray, fine grained, argillite. Hard to very hard

Bedding

60° 60° SE

Joints

* 348°	78° E		8" to 1' aver.
302°	61° NE		
285°	50° NE		
* 73°	56° N	Bedding?	question this
330°	72° NE		
345°	75° NE		
X 345°	40° SW	1' to several feet	

D-81-4

Appears that we are into igneous rock

A. fine to medium grained, light gray hard rock. Outer surface of the outcrop is covered with orange lichen. Mafic content is < 10% + Aplitic dike

Joints

* 355°	vert	spacing 1.5' aver.
2°	62° E	

350° 36° SW

295° 15° SW

Estimated maximum width of Dike is ~20'. Small ridge trending up the hill at approx. 0° to 5°

D-81-5 Aplitic Dike

Back in the dike (?) material. Argillite is on either side. Rock is very hard. Contact strikes 15° dip 77° E. Mostly gray fine grained rock. Appears to be ~20' wide

Joints

15°	85° SE	face of outcrop
60°	5° NW	
285°	76° SW	
317°	74° N	small fracture
	spce ~1.5' wide; spacing 1" to 1'	
315°	65° SW	close fracture
	aver. 3"; range 1" to 8"	

Ridge going up slope

~ 100' d/s of 81-5 — flagged
(up) the chute ~ 350', chute
splits, argillite on both sides &
in the middle. Dike material?
in outcrop higher up
Bedding
60° 50° SE

Didn't see dike up above, possibly
oxidized zone above is the dike
at the base, Minimum 12' wide
oxidized zone & outcrop at base
orientation 350°

D-81-6 Aplitic Dike
322° 78° NE trend of
another ridge going up slope.
Appears to be associated w/ dike looking
material but argillite is exposed on the
SW face. Beds are deformed, swirly

D-81-7 Quartzitic Dike
Small dike cuts through the argillite
Dike ~~has~~ oxidized to an orange or orange-
brown color. Dike rock is a v. hard,
dark gray felsic(?) material. Dike is
border on both sides by a phyllite. Dike is
approx. 4' wide. Contact is sharp,
tightly fractured zone at contact.

Joints
347° 87° E strike of dike 2" to 1'
290° 74° NE
349° 68° 2" to 8"

D-81-8 Quartzitic dike
Dike mat'l with material as veins &
pods in the argillite-phyllite. Oxidized to
an orange brown color. Flagged

345° - 350° 72° E irregular,
rough contact,
Can see oxidized zone, dike on
opposite side.
Flagged

Not as highly fractured along contact

TOD – Not sure of our locations today. Check the larger ones. Numerous dikes can be found in the argillite. One is characterized by an orange to orange-brown oxidized surface. The dike is generally hard and moderately fractured. These are generally associated with ridges. Their orientation is parallel or sub-parallel to the major joint set. There are many more dikes here than can be seen from a helicopter.
Not one of the chutes are associated with shear zones. Have seen no direct evidence so far. There is however one chute which was seen today, its orientation is parallel to sub parallel to bedding.

* Will need to get the spacing on the dikes

3-18-81

It's a mostly sunny day, around freezing at 7:30. Jim and I are working at Devil Canyon on right abutment.

Photo's: 1-3-4, 1-3-7

Have just set up a 1300' base line which follows the bends in the abutment. Begins at 81-1 and goes c/s. Outcrop is phyllite

Joint Measurements			81-1	PLOTTED 3-21-81
1.	271°	79° N	plane smooth	
2.	46°	64° SE	bedding plane cleavage	
3	47°	62° SE	"	
4	78°	39° N	irregular, rough	
5	315°	66° NE	plane, smooth	
6	340°	32° SW	" "	
7	62°	80° NW		

8.	53°	61° SE	bedding plane cleavage
9.	44°	14° NW	plane, smooth
10.	50°	58° SE	bedding plane cleavage
11.	342°	81° E	plane smooth
12.	350°	56° W	"
13.	351°	84° E	" [redacted]
14.	43°	21° NW	plane, smooth
15	108°	83° N	irregular, rough
16.	277°	45° N	plane, smooth
17.	327°	55 NE	" "
18.	271°	46° N	" "
19.	321°	56° NE	" " [redacted]
20	323°	59° NE	" "
21.	323°	69° NE	" "
22.	345°	88° E	" "
23.	347°	68° NE	" "
24	116°	74° NE	" "
25.	349°	vert.	" "
26.	47°	44° NW	" "
27	44°	7° NW	" "
28.	68°	39° NW	" "
29	341°	88° E	" "
30.	42°	51° SE	bedding plane cleavage
31.	54°	40° SE	" " "
32.	279°	49° N	plane, smooth

33.	58°	52° NW	plane, smooth
34.	345°	86° SW	"
35.	14°	56° W	"
36.	316°	62° NE	plane, rough
37.	337°	vert	" smooth
38.	12°	64° W	plane, smooth [redacted]
39	66°	56° SE	bedding plane, cleavage
40	340°	vert.	
41.	337°	69° NE	plane, smooth
42.	49°	85° SE	"
43.	36°	68° SE	"
44	334°	vert	"
45	52°	59° SE	bedding plane cleavage
46.	355°	59° W	irregular, rough
47.	350°	88° W	plane, smooth
48.	42°	61° SE	bedding plane cleavage
49.	10°	84° E	plane, smooth
50.	28°	69° E	plane, smooth
51.	85°	57° N	PLANAR SMOOTH
52.	65°	62° NW	ROUGH/IRREG
53.	50°	82° NW	PLANAR-SMOOTH
54	56°	80° NW	" " "
55.	42°	67° SE	BEDDING
56.	63°	57° NW	PLANES ROUGH
57.	355°	88° E	" & SMOOTH

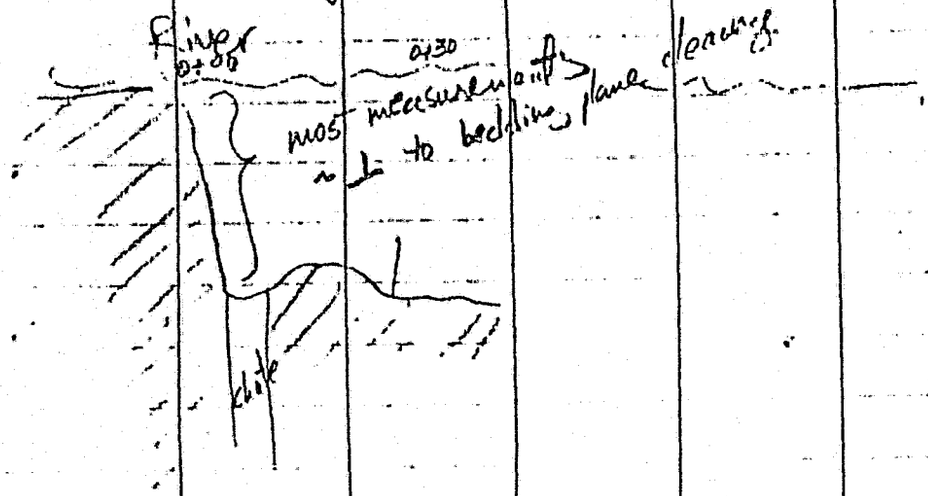
58.	82°	74° S	PLANEL & ROUGH
59.	309°	55° NE	" " "
60.	~357°	~28° W	" "
61.	63°	VERT	" & SMOOTH
62.	58°	86° SE	" "
63	35°	34° NW	" & ROUGH
64	40°	22° NW	" & SMOOTH
65.	49°	54° SE	" "
66.	51°	63° SE	~~NO~~ BEDDING.
67.	47°	26° NW	ROUGH / IRREG.
68.	50°	57 SE	BEDDING / CO_3
69.	318°	76° NE	PLANE & SMOOTH
70.	59°	17° NW	" "
71.	52°	7° NW	" "
72.	14°	82° E	" "
73.	58°	VERT.	" "
74.	45°	25 NW	" "
75.	345°	59° SW	" "
76.	46°	64° SE	BEDDING
77.	46°	35° NW	PLANE & SMOOTH
78.	350°	77° NE	" "
79.	67°	22° NW	" "
80.	58°	63° SE	BEDDING
81.	42°	23° NW	AVERAGE [redacted]
82.	20°	80° SE	

83	340°	82° E	PLANAR & SMOOTH
84.	322°	VERT	" "
85	15°	84° E	" "
86.	10°	88° W	" "
87.	354°	87° E	" "
88	60°	51° SE	" "
89	307°	64° NE	" "
90.	347°	84° E	" "
91.	338°	VERT.	" "
92.	342°	VERT.	" "
93.	348°	79° SE	" "
94	57°	59° SE	" "
95.	36°	33° SE	" "
96.	288°	79° N	ROUGH & IRREGULAR
97.	22°	45° NW	PLANAR & SMOOTH
98.	340°	80° E	[redacted]
99.	22°	11° SE	PLANAR & SMOOTH
100.	73°	VERT.	" "

PLOTTED ON SHEET 15 JANUARY 29th 1967

IT APPEARS THE ① STEEPLY-DIPPING NW SET & ② BEDDING PLANE CLEAVAGE ARE MAJOR SET - THE ③ 20-30° LOW ANGLE NW SET ARE SECONDARY. THE SAMPLING DISTRIBUTION MAY BE SLIGHTLY BIASED EITHER TO #1 OR #2.

Plan view of outcrop



Bedding plane cleavage is not always as prominent as it is here.

0+00 to 2+00

Almost a continuous exposure of phyllite/argillite to this point, probably no dikes. The joint set data at 0+00 applies through this zone, ie. all 3 sets are prominent.

2+00 to 2+20 Dike

A chute which we traversed up 2+00 is station 81-2. Found a dike exposed higher up.

2+70

Massive vein of white quartz, minimum two foot thickness

348° 28° E

4+00

Approx location of station 81-3 ?

D-81-9

5+10

Sheared outcrop (fracture zone), no gouge material intensely jointed, highly weathered, Fe & bleached staining. Some massive quartz associated with it. Approx 2' wide. Argillite is hard & baked on either side

Trend

342° 62° SW curved rough

6+60 to ~6+80(?) Dike at D-81-4

8+20 to ~8+40 Dike at D-81-5

oxidized orange to orange brown

E+55 Dike material ~ 12' wide
Strike of trend is also a prominent joint through the material
355° 71° E – pieces of dike
Sampled

Bedding plane cleavage ended ~ 6+00

9+00
Chute we traversed up near 1-5

9+10 Dike material minimum 10' wide
vegetation on either side

10+30 Dike material, ridge going up slope. Med to dk gray fine grained groundmass with white plagioclase & quartz xtals ~ 1/8"
20' wide D-81-6

13+10 4' dike D-81-7

14+50 4' Dike D-81-8

STATION D-81-9A
DARK GREY FN. GRN. MRG. MODERATELY HARD
MOD WEATHER/FRACTURED
JOINTS NO APPARENT BEDDING SINCE D81-8
317° 83° NE IRREGULAR - ROUGH
313° 70° NE PLANAR - ROUGH
69° 57° SE

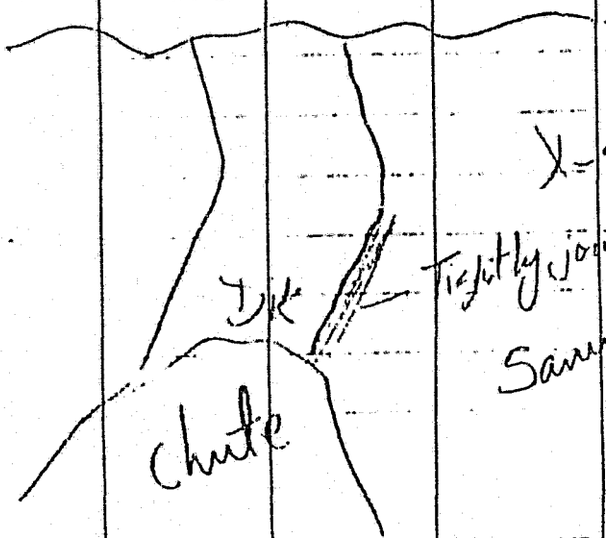
D-81-10 Rhyolitic dike
large outcrop of argillite, slightly phyllitic, quartz stringers throughout. Moderately fractured
62° 74° SE ~ bedding

Will proceed up this narrow chute to look at a dike

Approx 350' above the river ice, top of snow chute, base of dike.
Dike has an orange brown oxidized surface. Argillite is phyllitic on the east side of the dike. Argillite is baked in a 3" zone next to the dike.
The dike material is a light gray aphanitic rock. Dike is 20'-22' wide

Strike of dike & fractures associated w/ 340° 46° SW.

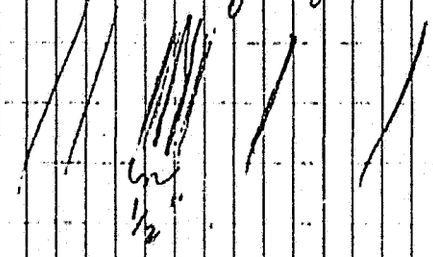
Fractures associated with, 3" 6" spacing. 3" first 1' from dike 6"
28° vert.
345° 65° SW } joints



Width at the base of the chute is 40'.
There is no chute/gully on the left abutment, opposite this chute, that falls in line. Could the river be a fault? The dikes/gullies are offset? No expression on other side.

Joints: at ice level river

55°	67° SE	~ bedding rough, irregular, open
46°	64° SE	
324°	80°	plane, irregular
37°	60° NW	
42°	61° NW	rough irregular
52°	76° SE	bedding plane shear filled with quartz, ~ 1/4" to 1/2" wide, thin plates of argillite associated with



Appears to be a (series) of these shears but not necessarily extending all along the bedding plane cleavage

Seeing bedding plane cleavage again

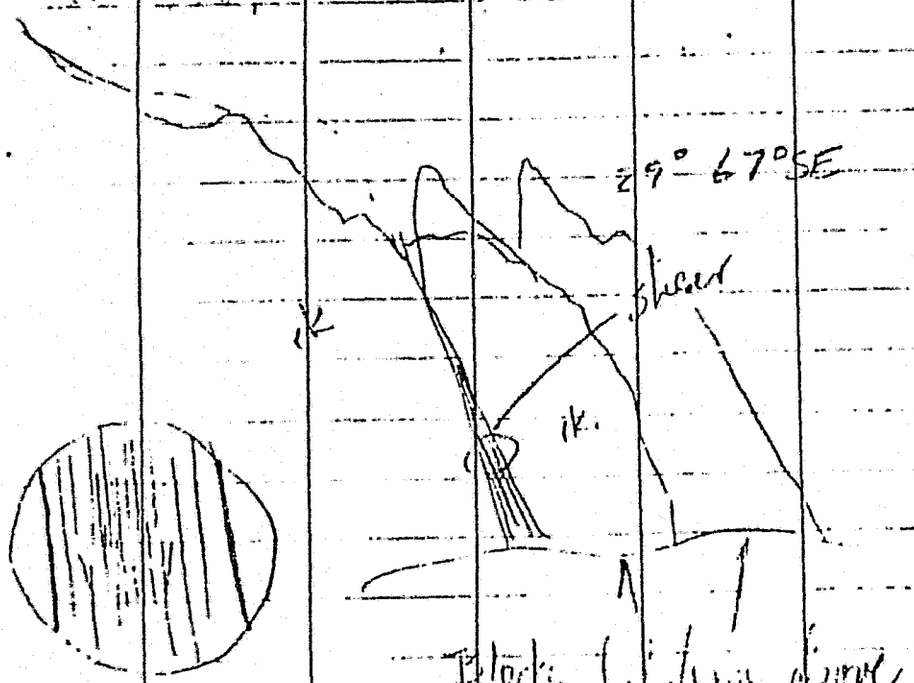
JOINTS

RANGE 6"-2'

309°/73° NE PLANAR & SMOOTH
310°/78° NE " "
311°/83° NE " & ROUGH
312°/14° NE IRREG & ROUGH
32°/68° NW

D-81-11

Bedding plane(?) shear ~ 4" to 1.5' wide. Fractured zone 1/4" to 1/2" plates



D-81-12

Dike which forms a long ridge going upslope. The rock is a dark gray, mafic rock with fine grained white plagioclase (?) needle shaped xtals. - Diabase Dike

Strike - guess
330° 77° NE west side
345° unsure? east side

Argillite is on both sides appears from the river ice that the contact is sharp, marked by a joint which is open. Appears to trend parallel to NW joint set. Estimated 30' across

D-81-13
(BASE OF ~300' VERTICAL CLIFF, ~40' ABOVE RIVER)
MED. GRNED. IGNEOUS ROCK (BIOTITE & FELDSPAR) QT2
COLOR INDEX 10-15%. MASSIVE SLIGHT
TO MODERATE WEATHERING; Tbgd unit

JOINTS
323°/69° NE PLANAR & ROUGH
327°/76° NE IRREG " "
20°/80° NW " " "
80°/23° N
325°/88° NE
46°/85° SE
75°/25° NW

~ Na-PLAG XTALS TO 1/4"
FRACTURED ZONE -
CURVED & ROUGH SPACING 2"-4"
335°/54° SW ↳ 1/2"-1 1/2"

? WIDTH OF DIKE TO 200'
~ 250' downstream of D-81-14

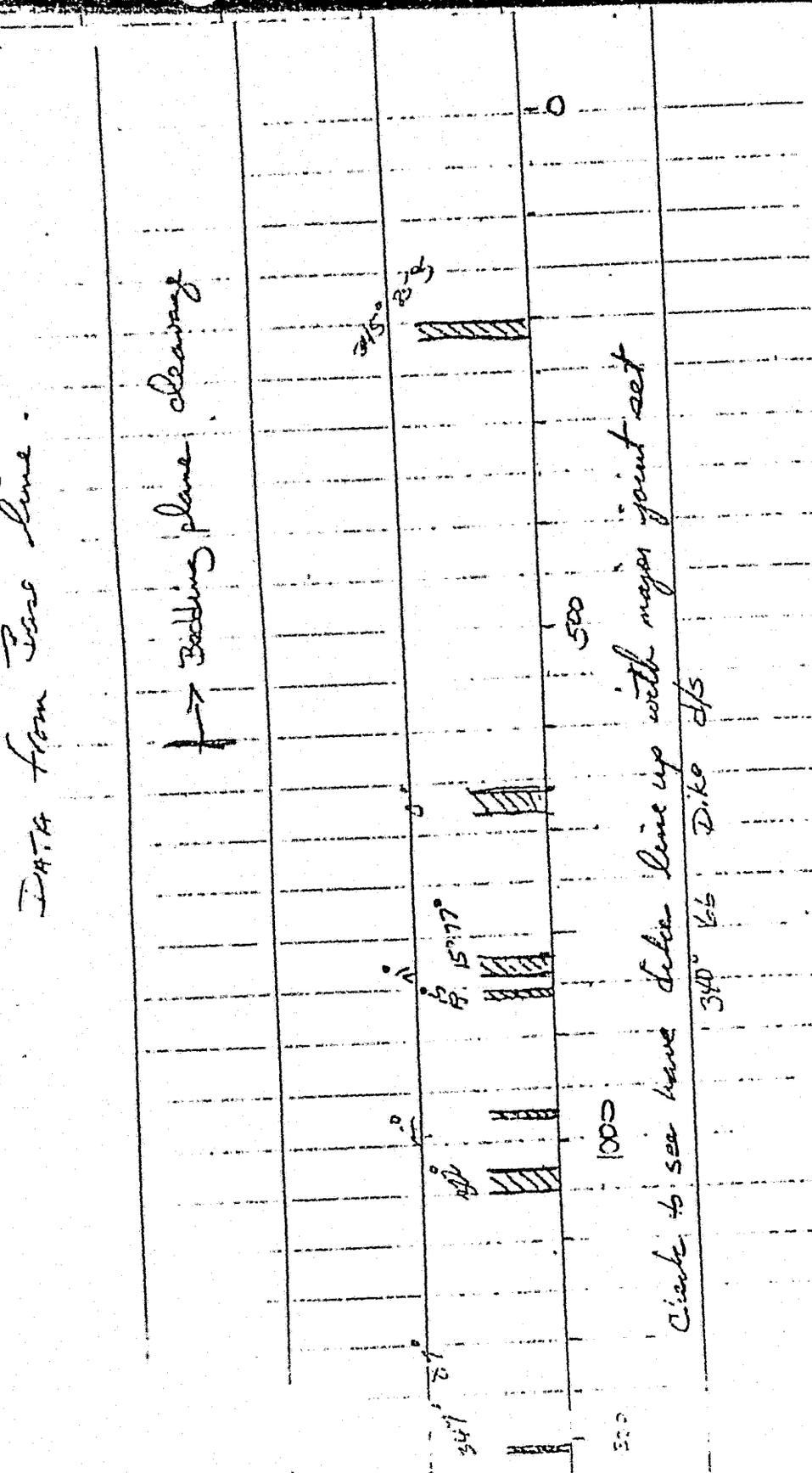
Sample taken of dike further d/s
Dike or part of stock (?) is
600'-700' wide at river level
width is based on several outcrops

West end is moderately to highly fractured.

81°	66° S	plane rough
300	61° NE	
211	66° E	
323°	55° NE	
16°	79° W	
0°	9° W	
349°	87° SW	
280°	38° N	

TOD - Have traveled way downstream from the dam. Accessibility is still a problem, need to use climbers on the dam site, a section of 700' to 1200' depending on budget. Feel that at this time, the best thing would be to look at Cheechako Creek. Have an idea on the joints, bedding, & distribution & kinds of dikes.

There was evidence of bedding plane shears at a few locales. The dikes vary in composition and most seem to be parallel or subparallel to bedding.



3-18-81

1:30

High, thin clouds, mostly cloudy, temperature ~32°. Ken, Jim & I are working in Cheechako Creek [#7,45-50]

Photos: 1-3-4, 1-3-5, 1-3-8

D-81-14

Near vertical exposure of argillite. (phyllite in places) It's a dark gray, fine grained, & thinly bedded. Bedding plane cleavage is

Strike of bedding

280° 89° N

Monument through here. Moderate hard.

Joint measurements.

274°	85° N	Bedding plane cleavage, irregular, rough 6" to 1.5'
353°	44° E	smooth plane 1.5 to 3'
0°	62° E	" " 6" to 1'

- also one joint set, rehealed w/ quartz difficult to get an orientation on
- ~N-S 50° W plane, smooth 2'-6'

West side of creek

89°	86° N	plane, smooth bedding
100°	vert	" " "
82°	84° S	" " "
328°	50° SW	" " , 2'-3'
87°	80° S	
347°	34° NE	plane, smooth 1' to 1.5'

Dike, diorite material, fine to medium grained biotite diorite. Max width 2', averages 1'. Is contorted & pinches out.

Ken is doing D-81-15 on creek, contact wavy through outcrop

D-81-16

Going up the landslide, in argillite so far, expect Tbgd above

Bedding

80° vert

The read & east side of the landslide chute is composed of Tbgd. A small pole of argillite is attached to the Tbgd. It is v. hard and baked to a low grade schist. Tbgd is a white gray fine to medium grained biotite granodiorite. Tbgd is hard, slight weathering, moderate fracturing. Where unweathered it is slight gray

Joints

68°	8° SE
16°	77° W
16°	30° E
275°	24° N

Walking upstream seeing all Tbgd

D-81-17 Mafic Dike

Vertical notch contains a fine grained dark gray mafic dike ~4' wide. Adjacent rock is the medium grained Tbgd. Dike is fractured 3" to 5" spacing

349°	89° vert	strike of dike & joints
41°	50° SE	spacing 1.5' in

Tbgd

Moved to left abutement just d/s of centerline. Ascending down a chute which one could go all the way to the river

D-81-31 Rhyolitic Dike

The light gray fine grained dike is exposed here. It's approximately 25'-30' wide, exposed on the u/s side of the chute only. Numerous small 1/16" - 1/8" quartz xtals are speckled throughout. Difficult

Kag
64° 48° SE bedding plane
cleavage aver. 1' range
1" to 1.5'

To get a trend on this dike. We are lining it up with a prominent chute on the right abutement

Guess
330° n vert

Argillite is moderately weathered & fractured

Sampled Dike

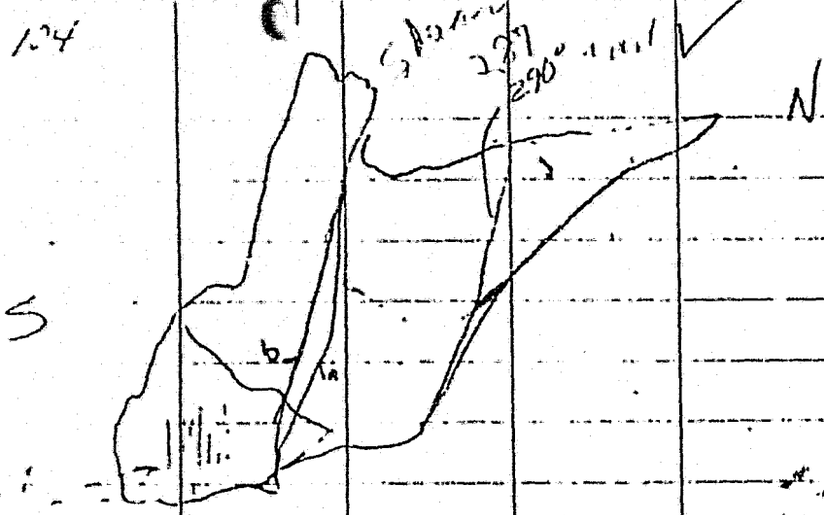
Dike is moderately to highly fractured just as in the similar material dike on the opposite abutement, D-81-

Kag - bedding plane cleavage
70° 57° SE 1" to 1'

TOD - The rock outcrop opposite the fan has a couple of prominent aplitic dikes. These dikes and adjacent argillite are highly fractured in fact most of the outcrop is highly fractured. Compare these dikes with those found u/s on the left abutement.

Found dike material in one of the notches/chutes on the left abutement. It is the same material as seen in the dike at 81-2.

Saw a moose carcass when traversing to D-81-31



Looking West

surface 10° 87°E
sticks are near vert
may belong to

274
(a) 277° 86° S } secondary
(b) 315° 312 78° SW
*(c) 310° 30 vert.

(c) begins at edge of outcrop & continues upstream for a minimum of 20', slope is covered by vegetation. Probably lines up with one of the chutes on the opposite bank. Rock is so rotten that it is difficult to tell if it has any flow structure, crumbles up easily upon hitting.
Andesite is exposed at river ice level ~20' u/s is sounder & better rock but not as good as it has been.

Could it be breccia with shearing again?

5+00 (is 81-40)
Contact of the gray-green andesite and the calc plagioclase rich, med grained diorite which is biotite rich. This contact zone roughly coincides with the adjacent sheared zone. It appears that the andesite is within the diorite. Some small rounded elongate pods up to 2" in length can be seen in the diorite. The contact between the two is sharp. Both rock units at the contact are only slightly weathered, hard, & competent. The contact is irregular & somewhat approx. vertical. A shear zone just u/s coincides with the contact.

6+60
Mostly the medium grained, biotite rich, calc plagioclase diorite. Some andesite is within, intermixed. Rock is very hard & competent. Outcrop is ~35' long & 6' high.

Small coarse grained, white, (felsic?) dike. Contains mostly sodic plagioclase with some biotite & quartz. Spacing 3' to 5', they are ½" to 3" wide

Trend 113° 25° SW 2"-3"
Photo #4

D-81-18
Walking to here have seen all Tbgd. Can't get to the vertical chute here as it is too steep & icy. Along the river there is no evidence of a dike or shearing, so it must follow the creek a ways. Fresh surface caused by rock fall are a light gray to buff (oxidized) color. The rock is generally blocky to massive. Hard

D-81-20
Trend of chute at 351-16,1 intersects the interior here
See K. White Book [#7, 49]
Photo's 7-16;

303° 84 SW to 60 NE
2.5 to 7° SE

On the Susitna River, left abutment upstream of Cheechako Creek mouth
D-81-21
Large Felsic dike. It's a light gray, very hard quartzitic dike with some flow banding. Bordered on [illegible] sides by argillite. Very sharp contact. May line up with dike opposite the fan.
32° 31° SE strike of dike
Argillite is hard & blocky. Some quartz veins & stringers. Stretched [illegible] particles.
Joints
154° 66° NE over 8" 4" to 1"
86° 30° S 4" to 1"

60° 37° NW
No layering or cleavage
Outcrop is large ~50' high &
100'
Width of dike is ~20' Argillite is
on both sides
Sampled

D-81-22
Medium to dark gray fine grained
argillite. Can't distinguish any
bedding plane cleavage. Bloody,
hard, slight weathering, non-foliated
stretched sand particles. Sampled
Outcrop is 200' high ~ 250' long
Joints
* 254° 75° E 4" to 1'
smooth & plane
60° 52° SE 4" to 1'
301° subhorizontal
295° 88° S
Outcrop is very large

~60' upstream another argillite
dike in the argillite just like
at 81-21
approx [illegible] to 4' wide at 65° 30° SE

Highly jointed zones in the outcrop
[illegible] 332° [illegible] spacing [illegible]
up to 3' wide

, [illegible] 7x need:

Discussion & evaluation of using technical climbers on the left & right abutement at Devil Canyon. — with Jim Heinzen, R&M

Mouth of canyon to nice smooth overhanging cliffs on left abutement a distance of approx 900' would have seven long traverses, one day each & and one short one. Each long traverse would take one day. Plan on some rest days because of hanging from a rope all day.

Should not have two people on a rope at once. One person above while one does the work. Could switch climbing every other day, therefore not many rest days would be needed, unless there are problems, i.e. weather, traversing, equipment, etc.

Need to points brushed for undistructed view of cliff. One below BH-1 and another just downstream. Also take the pictures from these two locations

Talk to J. Gill about new photos for D.C. i.e. no vegetation, from Cheechako Creek to 1 mile d/s.

Right abutement figure on 3 to 3½ traverses taking 2 to 3 days. Series of pictures taken of photos 16 through #24

Photo of D.C. looking d/s #25

D-81-25 [#7, 53]

Large outcrop of medium to dark gray fine grained argillite. Rock is very hard, slight weathering, blocky to massive. Numerous quartz veins & stringers, contorted. No bedding plane cleavage

Joints

*	346°	72° NE	1' to 2'
	49°	67° SE	
*	77°	62° N	4" to 1'
	64°	64° SE	[illegible]

variable

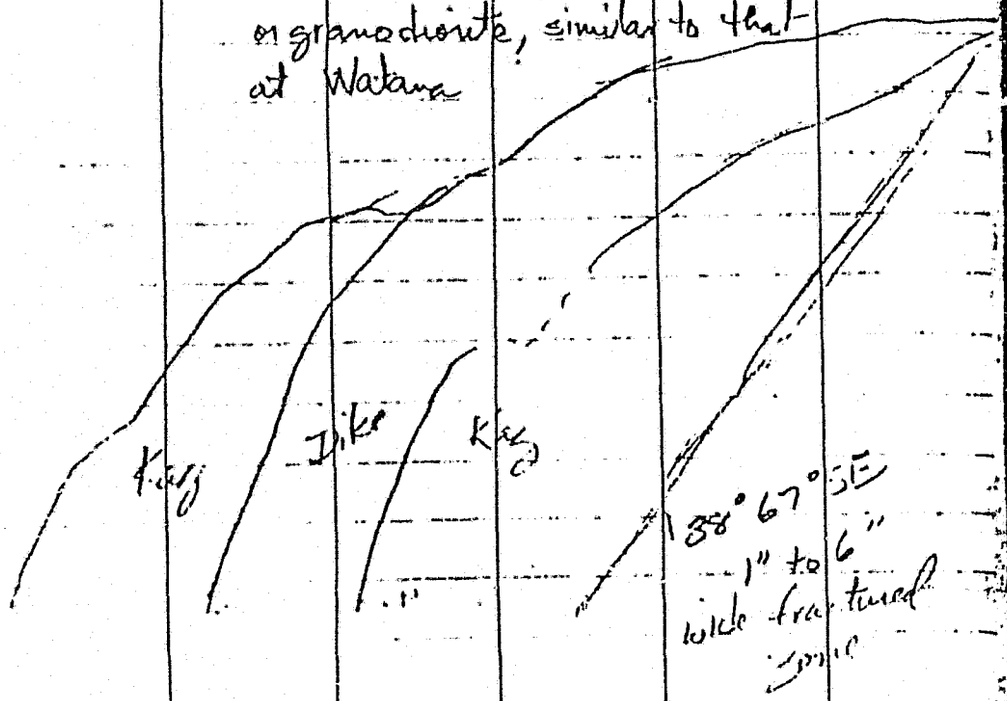
* 84°	12° S	1' to 2'
66°	82° NW	
70°	45° SE	

Around the corners in the embayment is a fine grained, green igneous dike on the order of 20-22' wide. It is fractured into thick plates. Fractures are concealed in places. Argillite is [illegible] hard, possibly baked on either side. Sharp contact.

Strike 7° dip ranges from 50°-70° E.

Sampled

* Dike is a fine grained green diorite or granodiorite, similar to that at Watana



320°	7° SW	2' + foot
345°	75-98° NE	[illegible]
352°	49° W	1'
35°	60° SE	2'
84°	70° N	[illegible] 3'
325°	56° SW	1'-3'

D-81-24 [#7,55]

Argillite to pyllite bedding has come around ([illegible]) & is steep. Bedding plane cleavage is tight to open (1")

See K. Whites book

Massive quartz veins - mostly rotten

Photo of D.C. looking d/s #27

Vertical shots 28 & 29

WCC linear #30 looking downstream on Chuchaka goes w/ 7 through #16

TOD –

Cheechako Creek – the rock type is nearly all Tgd. A few dikes were seen, a fine grained mafic rock & some small coarse grained felsic(?) dikes. One of the mafic dikes is associated with shearing & possibly with the WCC lineament. The shear/dike is wavy or irregular although the stretch of the river which probably coincides with is relatively straight.

Opposite the mouth of Cheechako, the Tgd outcrop observed last year is entombed by argillite. Observations indicate that the contact between Tgd-Ag is very irregular. On the left

On the left abutement upstream of the mouth of Cheechako Creek two aplite dikes are exposed in an outcrop. If these dikes are curved, they may line up with those opposite the fan on the Susitna

Should figure on at least two full weeks for technical climbers in Devil Canyon

Argillite seems to be on both sides of the river going u/s, Susitna followed path of less resistent rock.

3-20-81

It's a mostly sunny day, in the low 20s. Jim & I are loading for Devil Canyon & work on the right abutement opposite the fan. K.W. is working at Watana, finishing up the 'Fins' & on the left abutement

D-81-24 continuation on d/s end of outcrop – 100' d/s. Phyllite here is highly fractured, spacings are close. Over a 15' width several 2' to 3' zones of highly fractured rock (3 zones)

Joints

*	337°	vert	1" to 4"
	61°	67° NW	1" to 4"
	338°	vert	1" to 4"

D-81-25

DK GREY FINE GRNED. ARGILLITE. HARD BLOCKY → MASSIVE SLIGHT WEATHERING BED PLANE CLEAVAGE. FACE ORIENT 330°

JOINTS

332°/78° SW IRREG & ROUGH

~~B. PLANE~~ 2. 60°/59° SE SPACE 1"-3' AVE ~2'

307°/10° NE IRREG & ROUGH 6"-1.5'

- OUTCROP AVE 50' HIGH / SEVERAL HUNDRED FEET UPSTREAM.

D-81-26

Climbing up this chute, rk doesn't look like Rag, also it's a good x SECT for any possible dikes going through. Argillite is moderately weathered, tightly fractured in place. No dikes were seen traversing up, limited exposure.

Joints:

331° 52° NE plane, rough

spacing 1'-2'

ave. 1.5'

Possible Bedding?

274° 71° S plane-curved, space 1' range 0.5' to 1.5'

275° 74° S some quartz stringers

D-81-27

Mostly dark gray, fine grained, phyllite, some argillite. Quartz pods & stringers which are contorted in places. Pods up to 1.5' in diam. Shaly weathering. Prominent bedding plane cleavage.

Joints:

Bedding plane cleavage

50° 76° SE

72° 71° SE plane, smooth, qtz filling

80° 76° SE "

332° 82° SW " 1'-2'

aver. 4" - 1'

1° 33° E quartz filling, plane rough aver. 1', variable

73° 14° NW

aver 6" to 1', down to 1'

Presence of 3", sheared, intensely fractured along the bedding plane cleavage

52° 72° SE

Bedding plane cleavage varies from 50° to 80°

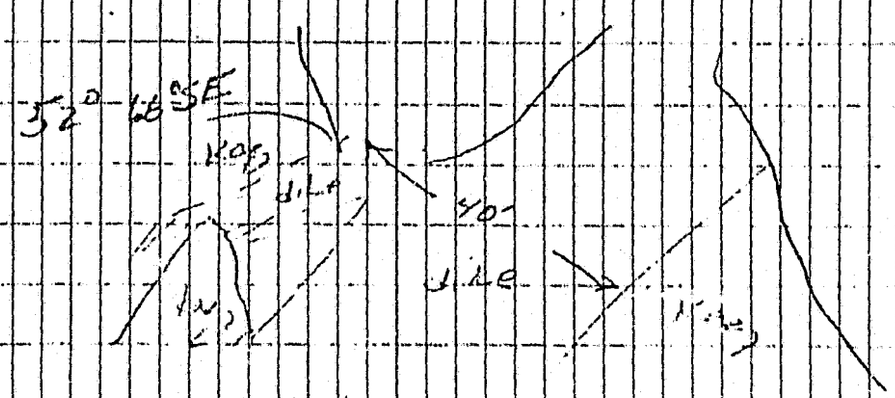
Shearing along bedding planes could be due to slippage of large blocks

D-81-28 Felsic to granodiorite (?)
Dike, white gray, fine grained rock. Highly fractured & Fe stained, to a light orange color. Fractured to [illegible] of 0" to 2". Dike is approx. 10' wide. Dike is felsic
37° 83° SE to vertical
- strike of dike

Fracture zone
350° 74° E tight fractured zone 6" to 1'

Dike should intersect the left abutement near the mouth of the canyon or on the slope walking upwards

D-81-29
- up 100' ~~up~~ chute
- continuation on dike at 81-28.
~ 40' wide



X - SECT

- up 200' - 250' on chute ? → is trending (?)
Dike at 81-28, 29 passes to the east through the snow covered slope. Felsic to granodiorite
Appears that another dike crosscuts the lower dike. It is also an aplitic dike, characterized by the Fe staining

Joints

	342°	66° NE - some intense fracturing zones assoc. w/
Kag	63°	50° NW
	290°	51° SW

all are prominent

east facing slope at ~ 200'-250'
converging fracture zone
334° 73° NE } cross across
350° 75° E } at w. edge of dike

contact on NE, up edge
350° 75° E of dike
Photo 31-35 NE facing slope of bend in river

200'
D-81-30 ~ 250' up the chute
Dike 50'-60' across, oxidized to an yellow orange to orange color
This dike should match that at 81-27
Heavily fractured. Felsic to granodiorite(?)
Contact
310° 80°-85° NE
measured on up slope side

All argillite, so far other than the dike, highly jointed throughout. Joints taken at time in chute
Joints
* 95° 44° S aver. 3" to 1'
* 0° 60° E
85° 60° S

* 356° 69° E 1' to 1.5'
355° 56° E aver 1'
345° 67° SE
355° 56° E
90° 81° S
5° 36° W
342° 81° E
330° 81° NE
359° 29° W 3" to 2' aver. 6"

Photo of chute #36

Can see rock exposed on both sides part way up, highly fractured. Farther up can only see exposures on west facing slope, all highly fractured all the way up
Orientation of the chute is: 15°

Photographs of right abutment opp. fan Roll #1 #37
Roll #2 #1 → 15
taken from 3 locations

3-23-81

Partly cloudy in the AM, burning off by noon. Ken & I will work on the right abutement at the Fingerbuster. Will get out ~ noon.

Photo 1-4-5

W-81-25 con't. pg. 47-51 [*7, 68]
~ 2+25

Fractured area some carbonate staining joints

305° 40° SW spacing ~3'
302

Shear that projects up through most of the area. The rock on either side
304
307° 80° NE
has been weathered, doesn't ring when hit with a hammer, that. Variable as to its width, seems patchy. Rock is highly fractured, ranging generally 6" to 1'. Alot of the fractured surfaces adjacent to have CaCO3.

No gouge in most. Fracturing ranges from 1/2" to 3".

W-81-29. ~ 2+60

Small chute w/talus at base walking up ~5' above the river ice level are two narrow shears. The first is subparallel to the river. It averages 2" wide, but may
281 284° 78° N
be up to 8" wide higher up. The zone is highly oxidized (weathered) rk that, hollow sound up to 1.5' wide. Surface is curved, rough filled with $CaCO_3$ & SiO_2. Rock breaks up easily, soft.

The other small shear has similar characteristics, up to 6" wide. No gouge
310
313° 88° NE

appears to be associated with other

crushed
~5' ~40' above

~40' up in the chute, some highly weathered & fractured porphoritic andesite outcrops in the chute on the east side
329 332° 86° SW
There is also evidence of crushed rock & sand size particles oxidized to a light orange with some red-brn, as a result of shearing. The crushed material is ~5" wide while the chute averages 5" wide. The chute is oriented ~339°.

Joints at base of chute
312 315° 80° NE
275 278° 9° N
67 70° 83° N-NW

2+80
Still in the porphoritic andesite, some flow structure still visible. Have a small shear of ½" to 1" wide. The rock on either
286 289° 84° N
side sounds hollow & is heavily CO_3 stained. Weathered surface has a chalky white color. Width of rotten rock is up to 1' wide

Joints
291 294° 80° N
344 347° 55° E
27 30° 71° NW
271 274° vert 6" to 1.5'
309 312° vert.
309 312° 2° NE 4" to 1'

4+20
~4 elongate zone of highly weathered and highly fractured porphoritic andesite. Seems as if its an inclusion, rock is really rotten weathers to a green orange white color

4+30
d/s edge of a low vegetated area between outcrops, several shears delineated here. Rock is highly fractured & weathered. Some silty sandy pale yellow to yellow brown gouge ~3" wide. Rock crumbles when hit. Weather surfaces in places resemble a "conglomerate"

Joints:

* 292° 289 63° NE 1" to 2'

* 8-12° 5-9 71° E 1" to 3' over 1'

87° 84 38° S

Went up some slopes @ ~ 7+00 & 7+50. See K.W.'s book for a shear on one of these chutes otherwise diorite is characterized by a light orange oxidation color. Check one of these chutes in the spring ~≥250' above the river.

W-81-41 4-42 [#7, 72 + 79

TOD - Some shearing in the rock exposed here. Some of the shearing & these chutes line up with the opposite face of the 'Fingerbuster' or chutes just [illegible], in rk outcrop back in from the river bank. Found the diorite andesite contact. The contact is sharp with some diorite inclusions in the andesite & vice versa. A wide shear nearly coincides with this contact, & should be considered so until found

otherwise. The dioritic inclusions in the andesite are [illegible] plagioclase rich, not [illegible] plagioclase

3-24-81

It's a partly cloudy day, with the morning temperature around 28°-30°. Will begin working just d/s from where we were yesterday. Then cross over to the left abutement & begin working back to the 'Fingerbuster'

Photo: 1-4-4 and 1-4-5

W-81-44

Qdized outcrop ~ 15' high & 15' long of the dark green porphyritic andesite. Since inclusions, still exhibits a flow structure. The outcrop has been sheared. Highly fractured with a wide range of weathering. The rock up 14' from river is rotten. White plagioclase phenocrysts to ½"

(a) 330° 60° NE clay & silt w/ 32' some sand ~ 2" wide

Joints - major

0°-5°	85° E	curved/planar, smooth
357-02		½" to 1', aver. 1"
70°-260°	85°N-85°S	curved, smooth
67-257		2" to 1' aver. 6"
250°-260°	12°-30°S	undulating, rough
247-251		3" to 1.5' aver 3"-5"
355°-5° 352-2	60° E	plane, rough, 6"-1'
348° 345		
60°	85° SE	plane, smooth 6"-1'

W-81-45 see W-80-68

Going c/s on opposite side of the talus slope. Outcrop ~10' high & 40' long of the dark green porphyritic andesite, virtually no inclusions or flow structure. Major joint runs through w/ CO_3 staining, 1" fracture zone.

Joints

possible shearing?

	332 335°	60° NE	plane, rough
*	317 320°-330° 327	70° NE	plane, smooth to rough open; 2" to 1'
*	82 85°	85° N	plane, smooth, some open 2" to 1.5' aver. 1'
*	60° 57	20° SE	irregular, plane, rough 2" to 2' aver. 5"
*	357-07 0°-10°	65° E	plane, smooth to rough 6" to 2' aver. 6"

major

W-81-46

Large outcrop ~60' above the river of the medium to dark green porphyritic andesite. Here we have inclusions of sodic rich diorite material & the dark material which appears to be argillite

in places. The face of the cliff exposure is irregular, rough, sitted, CO_3 stained, → moderately to highly weathered, the xenoliths are up to 1½" in diam. Cliff face, prominent side is ~ 310° 307 & vert. Hard to tell if there is a flow structure due to weathered surface

Joints:

*	350° 347	80° E	6" to 2', plane, smooth to rough, mostly closed
*	85° 82	65° N	2' to 4', irregular rough open to 2"
*	315° 312	vert.	plane, rough aver. 3'
*	70° 67	15° S	irregular, rough not continuous, 1' to 2', closed

Outcrop is ~ 35' high 70+' long.

minor 65° 62 85° SE plane, smooth to rough 6" to 3', closed

Possible flow structure

W-81-47 [#17, 80]

Dark green porphyritic andesite, exposed at river level ~ 12'-15' across 1' high

(u/s part may be sandstone, not andesite)

W-81-48 [#7,81]

U/s end of the large outcrop consists of the weathered porphyritic andesite. It is predominantly a light to med gray groundmass with the inclusions (argillite ?) weathered to a rust brown color. Some green spots in the groundmass are occasionally seen. The andesite is characterized by the lack of bedding a blocker mass (in relation to the sediments) and exhibits a shaly-type weathering. Groundmass has a greenish tinge to it in places.

a to scale

= small pes, rough, irregular surface

The concentration of white plagioclase phenocrysts seem to be higher. The rock is generally highly fractured & rotten, breaks into small chunks.

On one joint surface, see small 2" diam channels up to 2.5' long. Some of the oxidized flat joint surfaces exhibit a good flow structure - guess on flow

~ 352° 25° W
349

Further d/s in the outcrop a pebbly sandstone is exposed.

Shear in the andesite is a zone ~ 6' wide of rotten rock. Two small shears ~ 2" wide, one on u/s end contains aver 1" of silty sand, 310° ~ vert. while the other was mostly broken up rock.

Joints: - next to shear

Major
- 290° 75° N plane, smooth 6" to 3'
- 287 aver 1'
- 60° 57 80° SE plane, smooth ~ 2'
- 320°-340° 40° SW " , rough 6" to 2'
- 317 337
- 350°-10° 55°-65° E plane, smooth
- 347-07 open, aver 2'

Pebbly sandstone is oxidized to a buff, yellow & rusty brown color. The sediments have been highly weathered & fractured. They strike from 355°-9° and dip 15°-16° W. The contact seems to be irregular, i.e. noncontormable but it is difficult to trace.

The sandstone on its weathered surface is a light green gray containing small chips of argillite, quartz, feldspar etc. Appears to have some graded bedding. Some dire green shale interbedded.

Calcite can be seen along some joints. Bedding is on the order of a couple of wides to 2'

— crossed to left abutement

W-81-49 [#7, 84]

See K.W.'s book, station on the river. Several shears cross through the outcrop. May be sediment ??

~20' high & 400' long

W-81-50

Cliff exposure at small knob above the river. Large exposure (~40' high & ~60' wide) of the medium green andesite with only a few white plagioclase phenocrysts. Don't see any xenoliths or flow structure. Rock is very hard, blocky to massive and competent

Joints 52 — 1' to 2'

major { 55° vert plane, rough, closed
331° 329 78° NE " smooth, closed
323° 8° SW " " " 4' to 1'
320 — 1'-2'

W-81-51

Tuff(?) composed of a medium gray homogenous fine grained rock, interrupted with a green to gray fine grained siltstone & a sandy fine grained dk (some sedimentation accompanied with flows. Dark gray material appears to be a hard shale in places

Several prominent tightly fractured zones ↑ not left

305°-315° 86° NE - vert
302 312

may have some shearing assoc. with

If bedding then it's approx.

287° 10° S
285

The outcrop has a vesicular weathered surface

Sampled.

W-81-52

Possible contact been the medium to dark green porphyritic andesite & the sediments ??

See K.W. book [#7, 86]

W-81-53

A large outcrop bisected by a vegetated slope. Outcrop is ~ 15'-18' high ≈ 130' long. It consists of the dark green-gray porphoritic andesite. Contains xenoliths of argilleous & dioritic material (sodic rich) but for the first time there is some calc plagioclase). Diorite is up to 4" in length. No flow structure visible. The rock is hard, blocky to massive & competent. Weathered surface is slightly vesicular due to weathering of the plag.

Joints:

Major

295° / 292 — 68° S — plane, smooth, closed 1" to 1' aver. 8"

20°-40° / 17-37 — 70° NW — curved, rough, open aver. 6"

330° / 327 — 73° NE — plane, smooth aver. 6"-8"

subhorizontal sets are variable

W-81-54 [#7,87]

Large off and on again outcrop with three ice filled chutes which bisect the outcrop. The rock consists of a great number of diorite xenoliths surrounded by the porphoritic andesite in the interstices. The contact is sharp with no melt zone, diorite must be close to the surface. Xenoliths average 1"-2" in [illegible] get more plentiful going upstream. ~70% of rock. A major shear zone is exposed here, three.

340° / 337 — 75° NE to vert. — curved, irregular surface

They consist of sandy, granular fragments oxidized to a rusty orange color. The entire zone is ~ 3' to 5' wide. The crushed zones are up to 3" to 4" wide. CO_3 staining. Highly fractured zone associated with the crushed material is up to 1' wide. Rock is generally hard, competent.

Joints:

Major

340° / 337 — 85° W to vert. — irregular, plane rough, CO_3 coating, 1' to 3'

275°-285° / 272-282 — vert. — plane, rough, 4"-3'

Major 60° 12° NW, slightly curved, rough
57 closed 1" to 3'
Minor 65° 80° NW plane, rough, 5' spacing
62

5' wide chute joint upstream
oriented 15°

IV-81-55
Dark green porphyritic andesite, no
xenoliths of diorite. Some argillite.
Outcrop is 15' high x 35' long.
White plag phenocrysts

IV 81-56
Dark green porphyritic andesite with
numerous good size xenoliths of diorite &
some argillaceous material. Rock is
slightly to moderately weathered.
d/s end of long discontinuous outcrop
the diorite in places is oxidized to a light
orange color.

Joints 287
290° 80° N plane, rough
582 87° E irregular, rough
300° 297 75° SW plane, smooth
Difficult to reclaim spacing, other measurements
and dominant ones. Several fractures at 5°
orientation over a 2' width — fracture zone 1" to 3"

IV-81-57
Small chute ~ 4' wide oriented 302 305°
is covered by snow & vegetation. Took
some joint measurements in the porphyritic
andesite joints d/s & adjacent to. Difficult
to get a good idea on spacings. No diorite
xenoliths seen.
Joints 299
302° 77° SW planar, rough
17° 14 87° E ~4" plane,
smooth, appears to tight
77° 12° N plane, smooth 1" to 8"
74

W-81-58

Still in the dark green porphoritic andesite. The rock is generally hard & competent. At the edge of the gully which goes in here. Will get a good λ-sect. of joint measurements.

Joints: 299

302° vert.

60°57 13° SE plane, rough

30B line

closed 6" to 1.5'

320° 317 85° SN curved, rough

1' to 2'

85° 83 88° N

Find it hard getting good joint measurements.

W-81-59

The rock on both sides of the gully is the porphoritic andesite. The rock is moderately fractured but haven't seen any shears. May be difficult even after the snow has melted. Best rock exposures so far are on the u/s side.

Closely spaced jointing on the west facing cliff face, 2" to 6". The cliff face (small exposure) seems to be falling over. This fracturing could be associated

parallel to face — 339° 45°-50° NE

67°-80° NE more intact rock

with the probable shear or shears which trend through here.

W-81-60

Went up the gully which is adjacent to the 'Fingerbuster'. On the west facing cliff face, find the medium grained calc plagioclase & biotite rich granodiorite, think I can distinguish some quartz.

Walking d/s along the slope 100'-150' upslope, found diorite, somewhat finer grained, on the opposite side of the gully and then continuing d/s until I hit an andesite outcrop. The contact between the two is not exposed. There is a small gully that closely coincides & it is oriented 325°.

322

The contact closely coincides with this gully but is transitional or cuts across the small ridge (oriented ~ downslope), giving it an orientation of 305°
W-81-61 [#7, 88]

TOD: Began working on the right abutement, walked along the river from the porphoritic andesite into the volcanic clastic sediments. The edge of the large outcrop, v/s, seems to be composed of weathered andesite, the groundmass is a light gray color & there doesn't appear to be bedded, unless it is really massive. If it is andesite, it means that the andesite flow is stratigraphically above & below the sediments. On the opposite bank (left abutement) not sure if the light gray groundmass rock is the andesite or a clastic. I can see characteristics of both.

Where the diorite is close to the surface, the andesite has a higher concentration of diorite xenoliths.

Crossed from the porphoritic andesite

into the calc plagioclase rich diorite next to the 'Fingerbuster' on the left abutement. The contact isn't exposed but the diorite is finer grained near the contact.

Saw a few shear zones today, in the andesite & sediments on both abutements. Traversed part way up the 'V' shaped chute on the left abutement, but no shears were exposed. Believe that there probably are some here, check again after the snow has ablated.

(11 343°
2°

5-25-81

It's a beautiful clear, sunny day. A little cooler this morning, but nice, ~24°. Will work on the 'Fingerbuster' exposure on the left abutment, & then continue upstream.

Photo: 1-4-5 and 1-4-6

Stopped to get orientations again on the shear & adjacent chute on the right abutment base line 4+30 near W-81-40.

Trend of outcrop going upslope is 343° 340

This splits into two chutes one at 2° & the other ~335°
359 332

Start 'Fingerbuster' outcrop on left abutment, begin d/s & work u/s

D/S end consists of the medium grained calc plag & biotite rich diorite (possibly granodiorite). Outcrop is generally massive blocky, hard, competent. A few large blocks are not attached to the adjacent rock, i.e. along joints ~ 315° (312) & ~ 335° (332). Excavation of slope probably 60' in places. See F.W.'s book for more detail. 3-24-81

7,92] Zone of white gray diorite, higher amount of sodic plag, less calc plag. [illegible] acute shaped [illegible] of hornblende

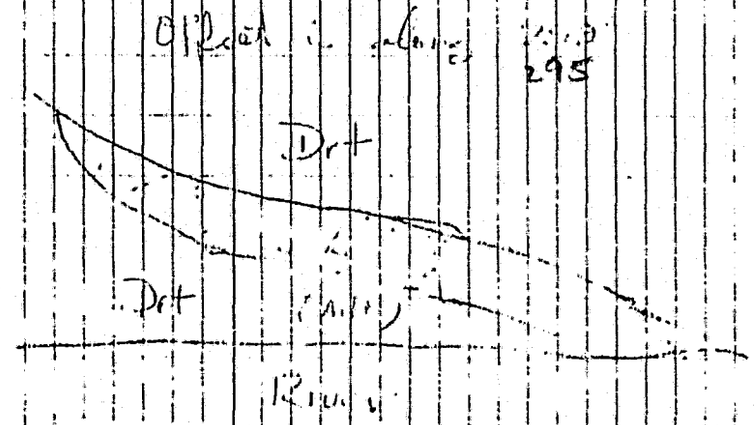
Small diorite dike, mostly sodic plag, melanocrat, finer grained rock material CI ≤ 10%. It's approx 18" wide. Dike material appears bleached.

43° 40' 34° NW

Some dark gray-green slightly porphyritic andesite is included in the diorite beneath the dike

A couple of diorite veins no offset up to 1" along some [illegible] joints mainly along a joint at 290°, diorite [illegible]

The 18" dike appears to be offset ~ 2.5". Fairly sharp contact on the up side while there is a [illegible] gradational, [illegible] contact on the down side. [illegible] against a curved joint oriented ~ 43° 34° NW



W-81-65

Going up this chute, see diorite at base on d/s side. Higher up the chute splits ~ 175' up slope

d/s one 5° 84° E ~ 12' wide

02 seems to be a mixture of diorite & andesite but mostly andesite

d/s one 250° [illegible] 5' wide

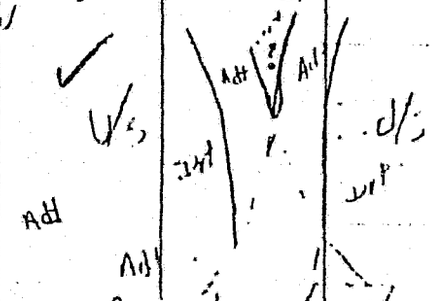
347 of andesite, dark green, slightly porphyritic(?)

The ridge in the center seems to consist of a fine grained calc plag diorite and the andesite. Coming down the chute on the u/s side, diorite is exposed. Several gray white felsic dikes (up to 4') are exposed in the face.

~ 100' upslope med grained calc plag diorite, fracture zone associated w/ cliff face, minimum 2' wide

352° - 358° 78° E. spacing 1'-3"
349 355 plane rough

Fracture zone
312
315 74° SW
286, 82° S
283



W-81-66

At the COE's nail in face. Have a shear zone here which may coincide with the diorite/andesite contact. Bar consists of a zone 12' wide of light green & yellow orange crushed rock zone, mostly sand size material

312
It is oriented 315° and dip 78° NE to vertical. The rock, diorite on u/s side diorite & andesite on d/s side is rotten on either side (hollow sound). Have carbonate staining. Curved, irregular surface. Difficult to determine how the andesite fits in here. Will measure the width of its exposure.

Est 125' tree w/ mid [illegible]
or ~160' if dike [illegible]

Andesite appears to be only [illegible] porphyritic, med. green color, [illegible] structure. Diorite is exposed [illegible] d/s.

Several possibilities
a) series of dikes
b) dike of sill

W-81-67 [#7,102]

Approx 100' upslope. Once several felsic dikes composed of diorite material mostly of calc plag. [illegible] white color. Can't see them extending upward.

as the slope is weathered & covered with vegetation & ice. The host rock is a fine & med grained, green, [illegible] (calc plag.), resembles andesite somewhat. Dike that I'm measuring is ≈ 1' wide

15° 60° E
12

≈ 5' apart

≈ 315° 25° NE ≥ 2' wide
312

Last way up the slope diorite is fractured & oxidized, a continuation of the shear at the previous station(?). Orientation ✓
327
est. 325

Where the two or three dikes are exposed, diorite is hard. Slight to moderate weathering.

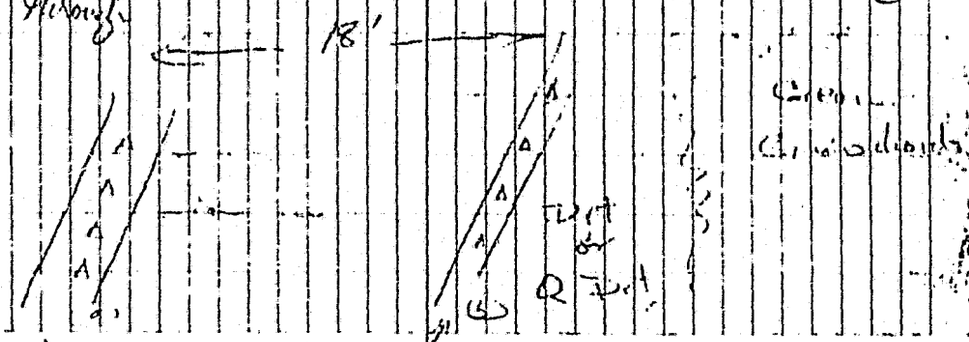
1 61-68

Large outcrop of the green medium grained, diorite. Loss of calc plagioclase. The rock is hard, blocky to massive and competent. Slight weathering, mainly oxidation of outcrop surface

Shear of approx. 4" to 1' wide crosscuts the outcrop. It is primarily a slight to medium orange zone of crushed rock, sandy [illegible]
310° 307° vert. ✓

Another shear ≈ 30' (to ↓) u/s. It averages approx. 3' of crushed rock material, small. The open fracture [illegible] with it is 1" to 7" wide. The surface is planed [illegible]
289° vert ✓
286

The u/s end of the outcrop is a white-gray, medium grained, diorite CI ≈ 20%. This section of the outcrop has been sheared and then [illegible] with [illegible] as it [illegible] the interstices. [illegible] the rock is hard, slight weathering, moderately fractured. Rock [illegible] along [illegible] [illegible] through



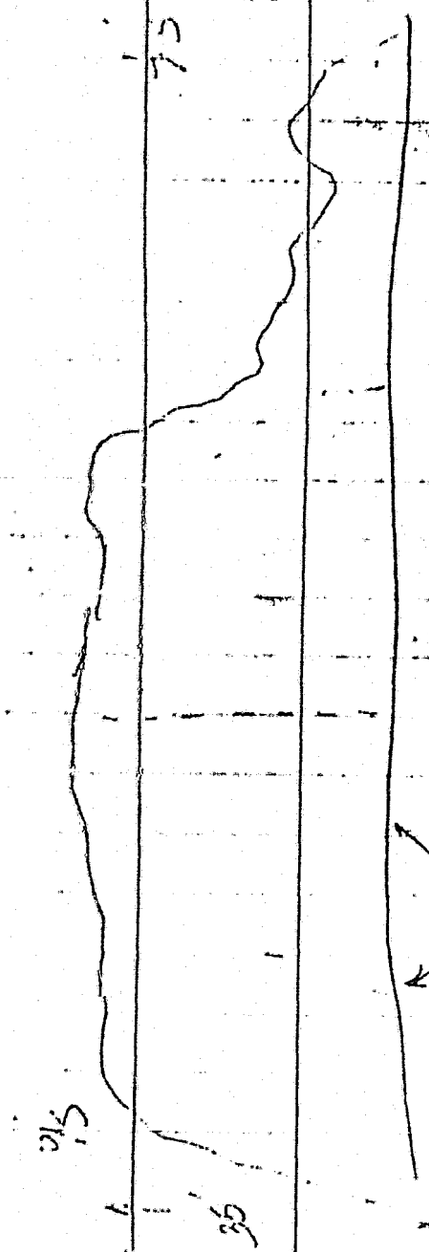
22

(2) 35° [illegible] 8" [illegible]

(1) 15' [illegible] 8"

12 80° N top

85° E bot



Green [illegible]

~140' long

Breccia zones

[illegible] diorite or [illegible] diorite

Joints:

Lt/Qtd

290° (285° & 245) 82° N plane, smooth, 1' to 3'
287

330° 70° SW plane, smooth, 3' to 2' aver. 1'
327

310° 60° SW plane, [illegible] 2" to 1'
307

340° 45° N [illegible] smooth 1' to 5'
337

75° 60° N [illegible] spacing [illegible] 1'
72

[illegible] (?)

[illegible] 52 88° NW plane, [illegible] 1'
347 [illegible] T [illegible] aver. 1'

315° 80° SW, [illegible] 1'
312

240° 7° S, plane, [illegible] 2" to 20' aver. 2'
287

50° [illegible] slightly curved, smooth to [illegible] 3" to 2' aver. 1'
47

[illegible] on either side of [illegible]

The next couple of small outcrops on the river is of the calc plag diorite, going u/s

W-61-69

A mixture of the two diorites, ie. it is a green-gray/white, medium grained diorite. Outcrop is ~6' high and 10' long.

W-61-70 [#7,107]

Mostly the sodic plag rich, gray-white, medium grained diorite. It's hard, competent & massive, but weathering, fracturing is tight near shear

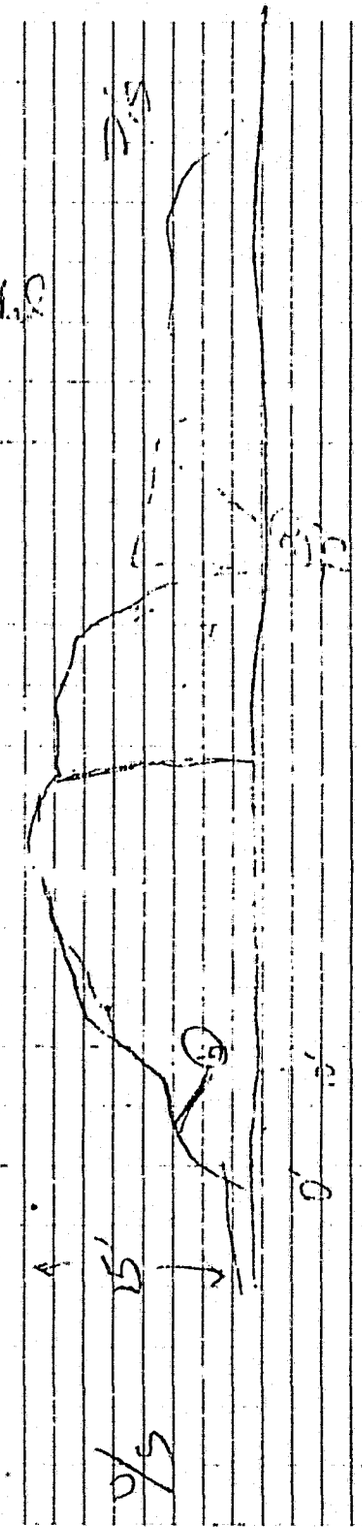
(a) 322

(b) 325° 83° NE zone of crushed rock & hard sage pcs ~ 2' wide zone. Sand sage particles. Rock is sound either side

(1) Ken White's book, med orange (dark), of sand sag material?

Outcrop is ~ 10' long. Some 1' wide gray white felsic dikes, in approx vertical of one subhorizontal

K.W. has joints



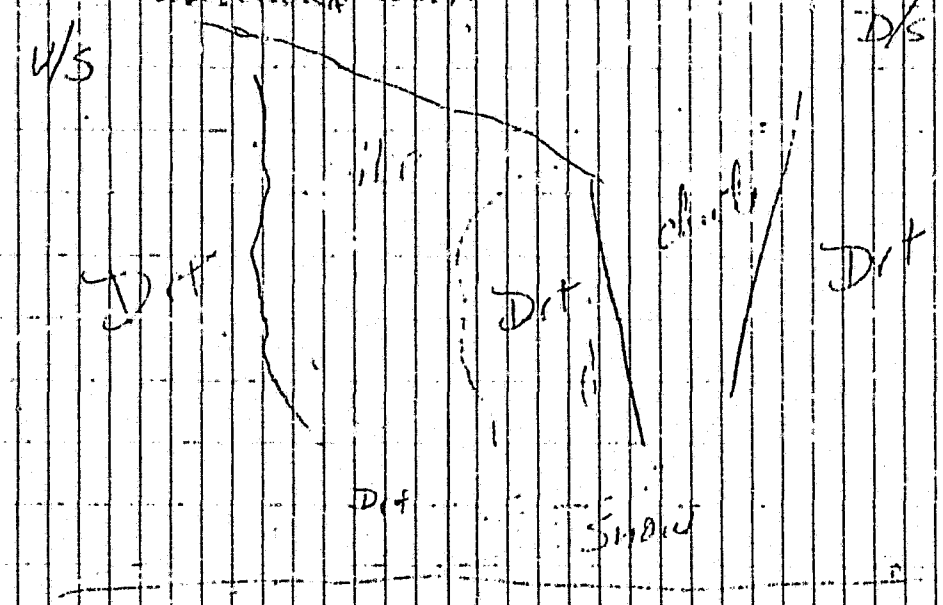
W-[illegible]-71

Nearly continuous outcrop with the last station and continuous upstream is where the rock gets out. Have the green, medium grained calc. plagioclase & biotite rich diorite. The rock is hard & exhibits a highly fractured & weathered zone. See KW's book [#7,109]

W-[illegible]-72

D/S end is mostly the green medium grained diorite. It has been intruded by several irregular [illegible], white (weathered surface) fine grained dikes. One is from 5' to 7' across. It is mostly hard completely [illegible] contact with diorite & no [illegible]

is associated with



Dikes are gray color on the [illegible] surface. Most of the diorite [illegible] green, calc. plagioclase diorite, some does get gray. Dikes are [illegible] [illegible] [illegible] [illegible] [illegible] only one which is [illegible] to the cliff [illegible].

49°46 85° NW [illegible] in the width

[illegible] to d/s end [illegible] [illegible] [illegible] [illegible] [illegible]

Sampled the dike, looks to be quartzite

There is a fracture zone here, ~ 3' to 31' wide, spacing 1" to 3".

~ 320° 77° SW

317

Joints: 308° 305 [illegible] NE

314 312 8[illegible]° SW plane, smooth to rough

6" [illegible]

281° 28° N irregular rough

278 6' to 2'

37° 40° 88° NW - vert plane rough

34 37 1' to 4' avg 2'

In places the diorite has been sheared with chlorite but haven't seen any [illegible]. Also, the rock isn't broken up along these zones of weakness as before.

W-81-13 finish on 3-26-81

A little further u/s is a small shear

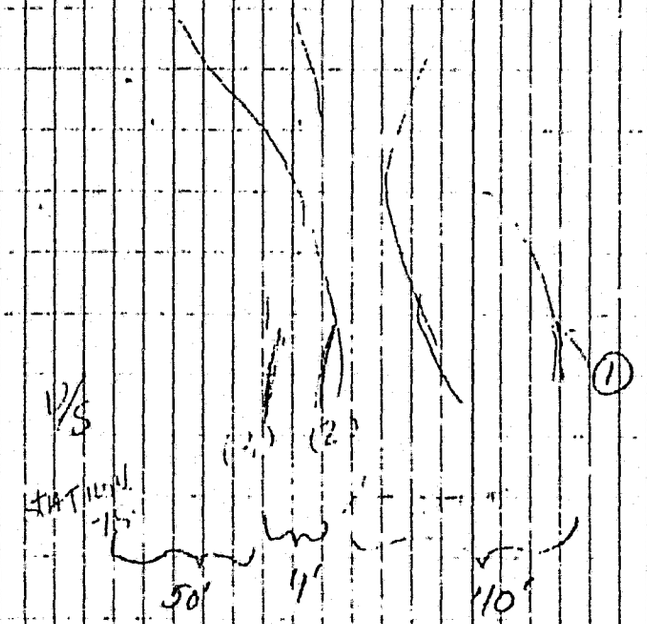
(1) zone ~ a 6" wide zone of crushed & rotten rock. The rock is [illegible] coated with carbonate. Breaks into small, thin irregular platy chips

78° 86° S

275

The shear is in the medium

grained [illegible] [illegible] fractured up in the chute.



327

(2) [illegible] [illegible] [illegible] its approx 6" wide with a [illegible] zone of about 1'. The [illegible] is [illegible] coated with carbonate and the [illegible] a [illegible] orange to white color. The material is sandy to granular.

(3) Another shear approx 1' wide of sandy material, similar to (2) except that a highly fractured & weathered [illegible] 4'

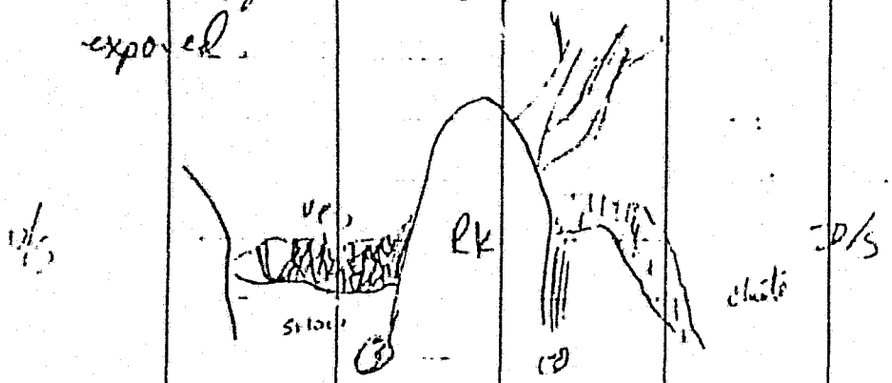
[illegible] 321° 318 ~ vert

[illegible] [illegible] with it.

TOD

Found andesite on the left abutement at the 'Fingerbuster' but could not get any idea on the areal extent & trend. Appears that it is a dike, hopefully we can get more information at the top of the cliff this summer. Only found a few shears exposed in this area.

Working upstream we were in the diorite (granodiorite), saw numerous shears exposed.



Joints: W-81-75 - see K.W's book

302	305°	70°SW	curved, smooth, 3'
42	45°	70°NW	plane, smooth: 1' to 2'
340	343°	50°E	irregular/plane, smooth: 3" to 6"

W-81-74 [# 7,111]
+75

3-26-81

Low ceiling today, snowing slightly and it's probably in the upper 20's, will work on joint measurements at the 'Fingerbuster' and approximately at the centerline on the right abutement and on the left abutement near the upstream cofferdam.

Photo: 1-4-6

WJ-9

Doing a joint [illegible] on the right abutement at the Fingerbuster. On the base line we set up it's from 3+30 to 3+80.

Between station W-81-39 & 40

1	328 331°	81° SW	curved
2.	319 322°	81° SW	
3.	40 43°	66° SE	rough
4.	70 73°	72° N	
5.	337 340°	86° NE	
6.	69 72°	84° NW	
7.	2 5°	79° W	

* CORRECTED VALUES MARED IN RED

8.	300	303°	85° SW	✓
9.	33	36°	83° SE	✓
10	353	356°	85° W	✓
11.	68	11°	79° NW	✓
12.	312	315°	vert.	
13	14	17°	82° W	✓
14.	270	273°	77° N	✓
15.	82	85°	75° N	✓
16	17	20°	75° W	✓
17	85	[illegible]	[illegible] N	✓
18.	333	336°	24° SW	✓
19	328	331°	85° NE	✓
20	59	62°	77° NW	✓
21	304	307°	89° SW	✓
22	315	318°	39° SW	✓ rough
23	291	294°	75° NE	✓ accurate
24	345	348°	55° NE-E	✓
25.	12	15°	74° W	✓
26.	294	297°	46° S	✓ rough
27	346	349°	79° W	✓
28	285	288°	84° S	✓
29	13	16°	75° W	✓
30.	4	7°	75° W	✓
31.	333	[illegible]	86° SW	✓
32	21	24°	68° NW	✓ accurate

* Corrected values marked in red.

33	340	343°	81° SW	✓
34	334	337°	79° SW	✓
35.	9	12°	4° E	rough
36.	275	278°	85° S	✓
37.	340	343°	38° NE	✓
38.	26	29°	85° W	✓ accurate
39	281	284°	47° S	✓ rough
40.	315	318°	81° SW	✓
41.	270	273°	72° N	✓
42	345	348°	56° NE	✓
43.	52	55°	77° NW	✓
44	276	279°	71° N	✓
45	60	63°	5° SE	✓ rough
46.	89	92°	79° SW	✓ accurate
47	296	299°	85° S	✓
48.	28	31°	70° W	✓
49.	330	333°	81° SW	✓
50.	279	282°	vert.	✓
51	354	357°	52° E	✓
52.	350	353°	52° E	✓
53	287	290°	83° N	✓ accurate
54	292	295°	vert.	✓ accurate
55	72	75°	11° S	✓
56.	0	2°	52° E	✓
57.	339	342°	38° NE	✓

58	2	5°	57° E
59	285	288°	79° N
60	275	278°	74° N
61	349	352°	55° E
62	0	2°	51° E
63	327	330°	83° SW
64	0	0°	54° E
65	294	297°	87° SW
66	62	65°	2° SE rough
67	0	1°	55° E
68	315	313°	88° NE
69	350	53°	53° E
70	15	18°	81° W
71	350	353°	56° E
72	25	28°	80° SE
73	312	315°	85° SW
74	297	300°	82° NE
75	299	302°	83° NE
76	69	72°	17° S
77	348	351°	88° W
78	62	65°	83° SE
79	285	288°	79° N
80	4	7°	16° E
81	78	81°	49° N curved
82	278	281°	84° S

* CORRECTED STRIKES MARKED IN RED.

83	288	271°	86° S curved
84	0	0°	86° W
85	285	288°	76° N $CaCO_3$ coating
86	280	283°	79° N
87	61	64°	6° SE
88	12	15°	55° E
89	331	334°	83° SW
90	339	342°	84° SW
91	52	55°	78° SE
92	13	16°	55° E
93	339	342°	80° SW
94	29	32°	66° SE
95	325	328°	85° SW
96	293	296°	76° NE
97	290	293°	80° NE
98	34	37°	72° SE
99	4	7°	79° E
100	291	294°	80° NE

Plotted on red sheet
DA: June 29, 1981 TS

Alot of small fractures in the rock [illegible] what we have measured. Unless noted all joints are plane, smooth, closed. Some carbonate staining along joints

Plotted 3-28-81

Spacing

V	[illegible]	steep to N	1" to 4'
		aver. 1'	; plane, [illegible]
III	[illegible]	[illegible]	6' to 3'
		aver. 1.5'	; plane, smooth
IV	subhorizontal		1" to 10'
		aver. 4'	; irregular & rough
		- zoned closely space & [illegible] at top	
		[illegible]	
I	330°	steep to rest	1" to 2'
		aver. 1'	; plane to slightly
		curved, rough	
II	NE set	fairly steep	
		aver. 6"	; plane to curved
		smooth	

Joint survey at approx W-81-26 centerline. Measurements taken over a span of 60'. Right [illegible]

~~WJ-10~~ NO [illegible] WJ-4 [illegible] 9/82

PLOTTED 4-1-81

1.	~~321~~	324	82 SW
2.	0	3	22 W
3.	26	29	46 NW
4.	42	45	31 NW
5.	24	27	26 SE irregular, rough
6.	320	323	79 SW
7.	328	331	62 SW
8.	57	54	77 SE
9.	319	322	80 NE
10.	38	41	81 SE
11.	325	328	32 SW
12.	33	36	85 NW curved, rough
13.	320	323	39 SW
14.	314	317	57 NE
15.	326	329	35 SW
16.	62	65	86 NW
17.	32	35	37 NW
18.	293	296	89 NE curved
19.	322	325	58 SW
20.	67	70	66 N

* Corrected values marked in red.

11.	341	344	68E
12.	327	330	59 NE
13.	329	332	54 SW
14.	0	0	61 E slightly curved
15.	317	320	56 SW
26.	67	70	58 N curved
27.	68	71	70 N
28.	325	328	60 SW
29.	331	334	54 NE
30.	65	68	59 N
31.	5	8	77 E
32.	12	15	77 E
33.	268	271	83 N
34.	74	77	47 N
35.	301	304	63 SW rough, qtz
36.	333	336	75 SW rough
37.	69	72	77 N
38.	356	359	84 E
39.	304	307	60 NE
40.	332	335	50 SW
41.	0	0	71 E
42.	342	345	58 NE
43.	14	17	87 W
44.	4	7	[illegible]
45.	1	4	74 E

* Corrected strikes marked in red.

Bruntons "Freezing up"

11.	344	347	37 W curved, rough
12.	34	37	84 SE
13.	299	302	25 NE
14.	322	325	88 SW sl. curved
15.	312	315	89 SW
51.	25	28	80 NW
52.	347	350	19 W irregular, rough
53.	307	310	90
54.	323	326	28 SW irreg., rough
55.	303	306°	vert. qtz coated
56.	39	42°	82° SE
57.	69	72°	1[illegible]° N
58.	309	312°	vert.
59.	10	13°	88° W
60.	58	61°	5[illegible]° NW
61.	9	12°	[illegible] vert. [illegible]
62.	49	52°	46° NW
63.	34	37°	82° SE
64.	288	291°	16° S rough
65.	321	324°	48° SW
66.	312	315°	65° SW
67.	303	306°	83° SW
68.	22	25°	60° SE
69.	22	25°	71° NW
70.	340	343°	77° W qtz. coating

*

71.	341 344°	28° SW	
72.	320 323°	86° NE	
73.	70 73°	80° S	
74.	72 75°	71° S	
75.	20 23°	63° E	
76.	15 78°	64° N	
77.	38 41°	32° NW	
78.	4 11°	77° E	
79.	19 22°	43° W	
80.	348 351°	57° E	$CaCO_3$ coating
81.	304 307°	vert.	
82.	291 294°	83° NE	
83.	337 340°	56° SW	
84.	333 336°	59° SW	
85.	55 58°	74° E	
86.	74 77°	21° S	
87.	313 316°	75° SW	
88.	35 38°	75° SE	rough
89.	308 311°	vert.	
90.	29 32°	64° SE	rough
91.	352 355°	45° W	curved
92.	76 79°	20° N	
93.	67 70°	vert.	
94.	293 296°	84° NE	
95.	324 327°	80° SW	

* Corrected Strikes marked in red.

86	89°	18° S	irregular
349	352°	35° W	"
51	54°	76° SE	
319	322°	80° SW	
75	15°	83° N	

Plotted on red sheet TS
DI: June 29th, 1981

Spacings
270° →

I 310°-320° steep plane to s curved, smooth 1" to 15' aver. 3' to 4'

IV ~330° ~15° SW curved, smooth 6" to 5' [illegible]

II NE dip steeply NW plane, smooth 2" to 2' [illegible]

III 12° steep to east curved, [illegible] 2" to 6"

IV subhorizontal irregular, [illegible] 1" to 2'

AAI Book 7.
P 5701.05.06

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WCC 129

3/9/81
4 PM Leave Buffalo for Anchorage
arrive 10:30 PM

3/10/81
Called Mike B. at office to find out when we're going to field: Thursday morning
∴ Go to airport and pick up rental car. Arrive at office ~ 11 AM
Spent most of day getting ready for field work.
Also went to COE to pick up photos taken by Chem of Watana + Devil Canyon sites

3/11/81 Prep for field
Bough Mittens & [illegible] $1700

Leave 8 AM (3/1[illegible])
Merrill Field - Ashland
Unpaved Hyd FRA Hangar

3/12/81 Leave Anchorage at 8:15 AM
To talkeetna (flyed wing)
to site (helicopter)

Out to Watana at 1:30 PM
Land on river upstream of
"the Fins". Walk downstream
along outcrops on north side.
Outcrop immediately upstream
of Fins appear to be andesite
porphyry and not diorite
as originally mapped. Hiked
upstream to gully (marked
(W-81-1) where andesite
porphyry(?) grades to aphanitic
andesite. West wall of gully
is dense aphanitic andesite,
Med to dark green with blocks(?)
of diorite

~~W-81-1 (see photo [illegible])~~
~~Med grained diorite~~
There are
zones along the wall of
very closely spaced joints (see
M. Bruen's Fieldnotes). East
wall of gully is med. grnd.
diorite near bottom (to 200 up
slope). Further up slope inclusions
of fine grnd metased or metavolc. and,
rarely, biotite schist become
common. Blocks are from 1 to 10 ft long
~~East of the wall~~ and become more
abundant and larger in
the upper half of the gully.
Outcrops are scattered east of the
gully but appear to be diorite
without inclusions.
The contact between the andesite
and diorite is not exposed. In the lower gully
the contact is assumed to be in the gully
The diorite outcrops on the east wall
are weathered and stained similar to
areas bordering shears in the Fins.
Trend of gully is 330 which is

327

parallel to the major joint set

Andesite Porphyry → grading to Andesite

Gully

Diorite

Fractures

Possible Shear

Inclusions

Filled with Snow & Debris

[#6, p1-4]

3/13 Watana Ptly Cldy 20°

K1-11 to 20

Photos ~~10 to 19~~ Panorama of "The Fins"

Photo ~~20~~ K1-21 view looking downstream from Fins

W-81-2 (Detail in M. Bruen Notebook)

Med grnd Diorite

Dike on upstream side, 10°/Vert

6", fn grnd felsic

rock on upstream broken along

very closely spaced fractures, tight

[#6, p5]

K1-22 & 23

Photos ~~21 + 22~~

W-81-3 322/75

Shear zone 225°/85° E

Establish base line along Fins

750' long @ 30° see map

W-81-4 Porphyritic andesite (station 1+50)
Joints (1+20 to 1+75' along baseline) [#6,8]
Major 310-325°/66-75° NE 70
307 322
Spacing 1-2', planar but rough, some CO_3 fully surfaces pitted where phenocrysts weathered out
Three 1-2" shears within fractured rks parallel to these joints

292 50
Minor 295°/45° SW planar, rough
297/50°
surface, pitted as above
spacing is irregular and discontinuous, say av. 1-2'
Two sets give blocky texture to outcrop

Photo 23
K1-14
Gray grain porphyritic andesite with phenocrysts of Plag + Hbl (6 X/mm)
some Hbl wthd. to Chl.
fresh, hard, competent, 2 dio
a few blocks of med grnd/occur as pendilites

K1-25 + 26

W-81-5 [#6,9]
Photos ~~24+25~~ at station 2+20
downstream of Photo 23
Note change in orientation of joints, more pronounced subhorizontal developing and few
307 310/65 NE joints
more massive

W-81-6 Diorite, grayish white
med grained injected by
[#6,10] numerous veins (less than 1/4") of chaotic andesite
fresh, hard, competent

2 Shear zones (see M. Brown's no block for detail)

K1-27
Photo 26 looking 10° along strike of shears
note gully in ridge behind shear, possible continuation
Check cont of shear on south abutment

Station 3+50 : Shear zone
crushed rock and clay
gouge, highly oxidized (limonite)
and sev. wtd, soft,
width uncertain due to rubble
in gully, 10 ft wide area
exposed

W-81-7 (?) [#6,12]
Shear 330°/82° SW
1-2' wide 327
clay/silt gouge, highly oxidized

Med grnd diorite

W-81-8 [#6,12]

W-81-9 [#6,13]

The Nob

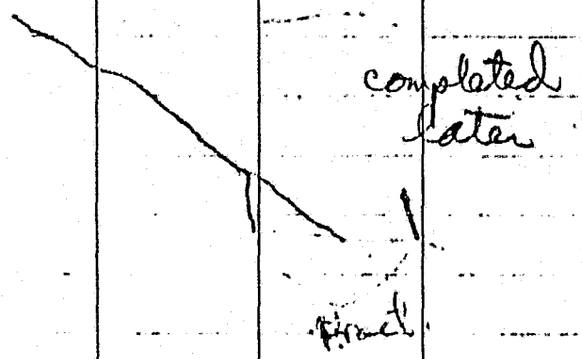
W-81-10 Andesite Porphyry [#6,14]
grayish green, phenocrysts of
Plag to 1/4 long, trace Hbl
Fresh, hard
Fractured along

Joints 350/40 W 2" to 1 ft
smooth, planar
somewhat discontinuous
330/71 SW 1-2'
smooth planar

W-81-11 See amphoto [#6,15]
highly fractured zone
very closely spaced fractures
discontinuous, and irregular
fractures cemented with CO_3
cannot determine orientation
(may be parallel to joint 350/55 W
which has 1/2" crushed rock)

W-81-12 [#6,15]

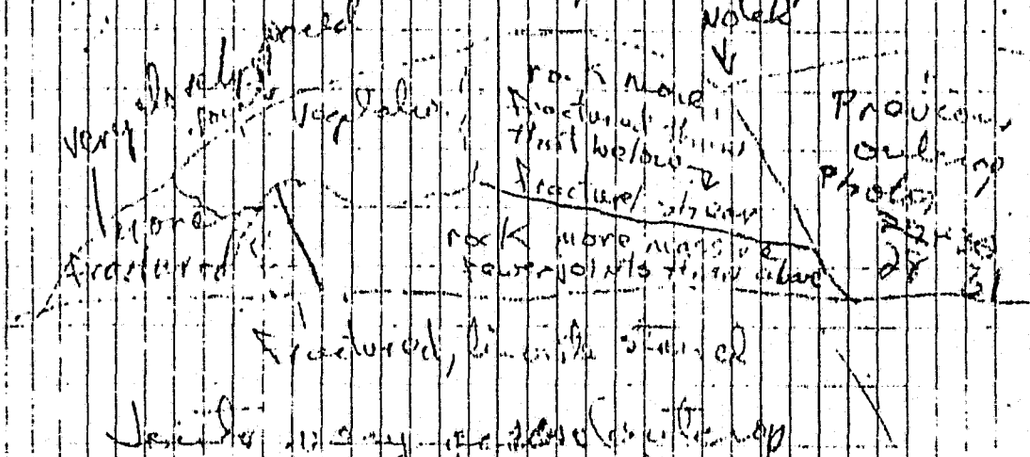
See topo map W-81-13
Fracture zone — Andesite
branch 357 / 76° W — 1 ft wide
main 345 / 39° W
K1-28 +
Photo ~~27~~ + 30 31



3/14 Watana Hly Cldy 22°
W-81-13 Same outcrop as above.
Face of cliff [illegible] 290°
Broken along joints:
major { 330° / 83° SW smooth curved surfaces, "
{ 220° / 68 E

Some compositional layering of feldspar along flow lines trending N/30°W

See topo map
Upstream of previous outcrop
andesite porphyry to Diorite
groundmass varies from aphanitic
to fine grained, 1/4 to 1/2 in
phenocrysts of feldspar and Hbl
inclusions of andesite & diorite & argillite
from 1 into 6 in dia.
fresh, hard competent
K1-32, 33 + 34
Photos ~~31~~ + ~~32~~ of outcrop
note low angle shear/fracture



Joints very [illegible] outcrop
no [illegible]
W-81-14 [#6, 20] 37
Photos 35 + 36 see topo. Prepared a
Roll 2 Photo ~~[illegible]~~ [illegible]
K2-1+2
Continued upstream and mapped andesite/diorite/argillite contacts on airphotos
W-81-15 through 23 [#6, 22-28]

returned downstream
On "the nob" across from Fins.
K2-3 to 8 Photos 2-7 Panorama from Fins - across river to south abutment

K2-9 to 16 Photos 8-15 Panorama looking upstream from the nob

K2-17 to 22 Photos 16-21 Continue downriver from Photo 8, taken from notch on the nob

Mapped diorite/andesite contact on the Nob and checked notch on upstream side for possible shearing. Notch filled with snow and rubble. Trend seems to align with major joints. Returned to river through saddle (knee deep snow) between Nob and south abutment. Outcrop of diorite on low ridge (see topo) in saddle. Below outcrop section of drainage aligns with main shear in Fins.

Crossed river to Fins and did joint survey at station 7+50 in diorite [#6, 28]

3/15 Watana Survey, cold
Continue joint survey at station 7+50

W-81-3
K2-25, 26, 27 + 28
Photos 24, 25 + 26 + 27
25 ~~24~~ looking west to outcrop
26 ~~25~~ + 27 ~~26~~ looking north, note
28 + 27 ~~27~~ shear
K2-27 ~~28~~ shear
K2-29 shear
K2-31 + 32
32 ~~31~~ view looking north toward cross-shear [illegible]

K2 - 33, 34, 35 + 25 Joint station at W-81-5 [#6,42]

Sample at W-81-5

After lunch went upriver to andesite/basalt units and collected sample for K/Ar dating for WCC

Returned to site and began joint survey at the nob. Not finished, will complete tomorrow. W5-6 [#6,35]

For tomorrow
- check orientation and width of shear in Fins
- finish joint survey
- check conditions at Devil Canyon

3/16 Watana, Fingerbuster area
Ptly Clay

Establish base line along North shore

Station 7+50 on topo
0+00

253°
7+50

7+50A
258°
8+50

W-81-24 Sta. 0+30 to 0+65
[#6,48] light to medium grain and site with plag phs. [illegible] to [illegible] inclusions of diorite and [illegible] argillite, av 4 to 6 in fresh, hard competent. Fractures along a few well defined joint sets. Inclusions in some places are 50% of rock. (Diorite breccia?)

Joints 277
Major 280 / 86 S
Spacing 2-3 ft in more massive sections but 6' to 1' in more fractured zones
planar to slightly curved, rough
2" 27 / 17 W
Spacing 6" to 1 ft
planar, rough

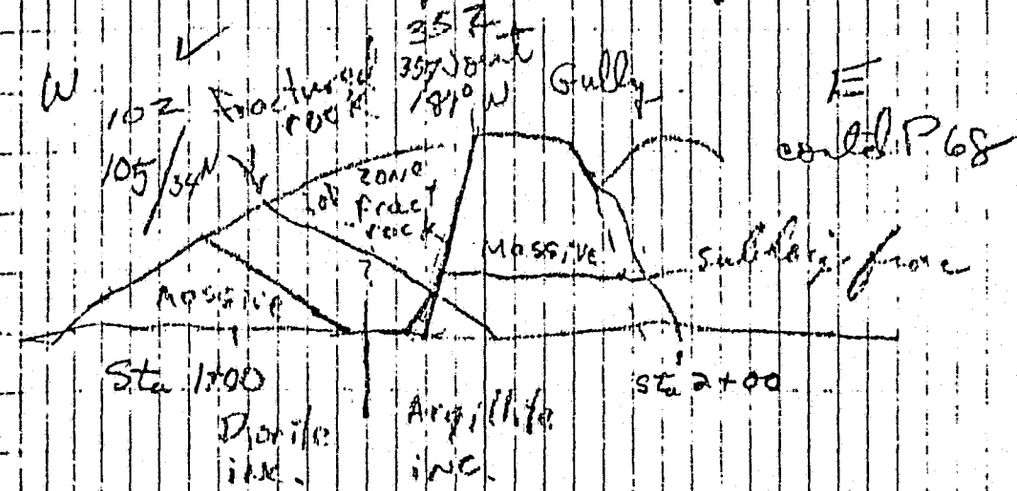
Structural conditions are similar bet. Fingerbunter + Finn in that shears are prevalent in the contact area between the diorite and andesite.

K3-2+3 Photos 2+3 Closeup of inclusions

Photos 4+5 outcrop from 0+50

Sta 1+25
Inclusions change from Diorite to all fine grained sed or volc. prob. argillite change within several feet

Andesite changes to light green with larger plag phenocrysts (andesite porphory)
Inclusions aligned along flow structures (310 to 350/15 W)
Inclusions generally tabular av 3" long, to max of 1 ft



Andesite Porphory

return to camp to pick up Jim Hanson (R&M technical climber)
Spent most of afternoon checking out Devil Canyon for safe routes along ice for mapping
The critical area along the dam axis is inaccessible due to lack of good ice

from DJ-2 to DJ-3

K3-6+7

Photos 6+7 view toward south abutment showing joint set dipping toward river

K3-2 [illegible] from DCJ-2

Return to Watana and finished joint measurements on "the Nob"

things to do:
- Photo the Nob from across river
- Plot joints
- the Fins shears

W-81-25 [#6, 50]

~~[illegible]~~

3/17 ☁ Cldy, windy, 20°

KJW - Watana, upstream of finger buster
MB - Devil Canyon

W-81-25A (Photo 9) K3-9
Diorite, med grnd, gray, fresh, hard, competent, well [illegible] joints give outcrop a [illegible] texture, steeply dipping joints hemonite stained

JOINTS

52
55° / 34° S
Spacing 1-2 ft, smooth to rough planar

Major 347 342 327
320° to 345 (av 330) / 75 SW - 90°
Spacing 6" - 1 ft, planar, smooth to rough

Major
355 to 15° / 85° W to 80° E
352 Dip to west, more prevalent
Spacing 6" to 2 ft, mostly 2 ft planar, smooth

Minor
57 60° / 85 E to 85 W
smooth to rough, irregular ✓
Spacing 6" to 3 ft, av 1 ft

Minor
280° / 50 to 60° S
2^ Smooth, planar, discontinuous, ✓
spacing very irregular
1 ft to 5 ft (?)

Minor
^ 320 / 20 S
smooth but somewhat irregular surface, planar overall
spacing 3" to 1 ft

outcrop oriented 300°
readings over approx 75 ft

Sample W-81-25 A

Photos 10 + 11 K 3 - 10 + 11
Looking SW
Joints dipping toward river
some appear sheared
potential failure surfaces

at east end of outcrop, 10 ft wide zone of very closely spaced fractures, limonite stained throughout

W-81-26 upstream from "25 A"

Diorite, med grnd, fresh, gray hard, competent, jointing well developed, a series of fractured / shear (?) zones are along the major joint set (NW trending, near vertical)
Zones marked on topo map
Also series of low angle fractures dipping out of cliff

Joints
Major 30° 32°
I 305-330° / 80° SW ✓
Smooth and rough, planar
some have calcite coating ~ 1/8"
Spacing 1 to 6 ft, av 1-2 ft

Zones of fracturing along thin
open to tight, generally open
part near fractures

II 30-40° / 80 NW - 90 SE ✓
smooth, planar to slightly
curved, discontinuous, some CO_3
spacing 6" to 2 ft, tight

Minor
III 350-8 / 55-60° E
smooth to rough, discontinuous,
some with CO_3 coating
planar and irregular
spacing 3 ft

340-355° / 45-60° SW
Smooth, generally planar but
occ. curved, slightly open
spacing 2-4 ft

K3-12
Photo 12 view of '26"
looking NW

See topo Map
Zones of open joints and
v. closely spaced fractures running
parallel to NW trending rel.
slight to moderate weathering
fractured areas. Erosion along
these areas [illegible] gullying.
On north side of gully a
Low angle fracture (15°/45 E)
dips out of hill. Open 1/2"
some fracturing

✓ DIP

W-81-27
Fractured zone, some shearing
rock broken along v. closely
spaced fractures, [illegible]
to severely weathered
Thin layers of [illegible]

Width varies from 6" to 2 ft
350° / 65° W

K3-13
Photo 13 Closeup of zone

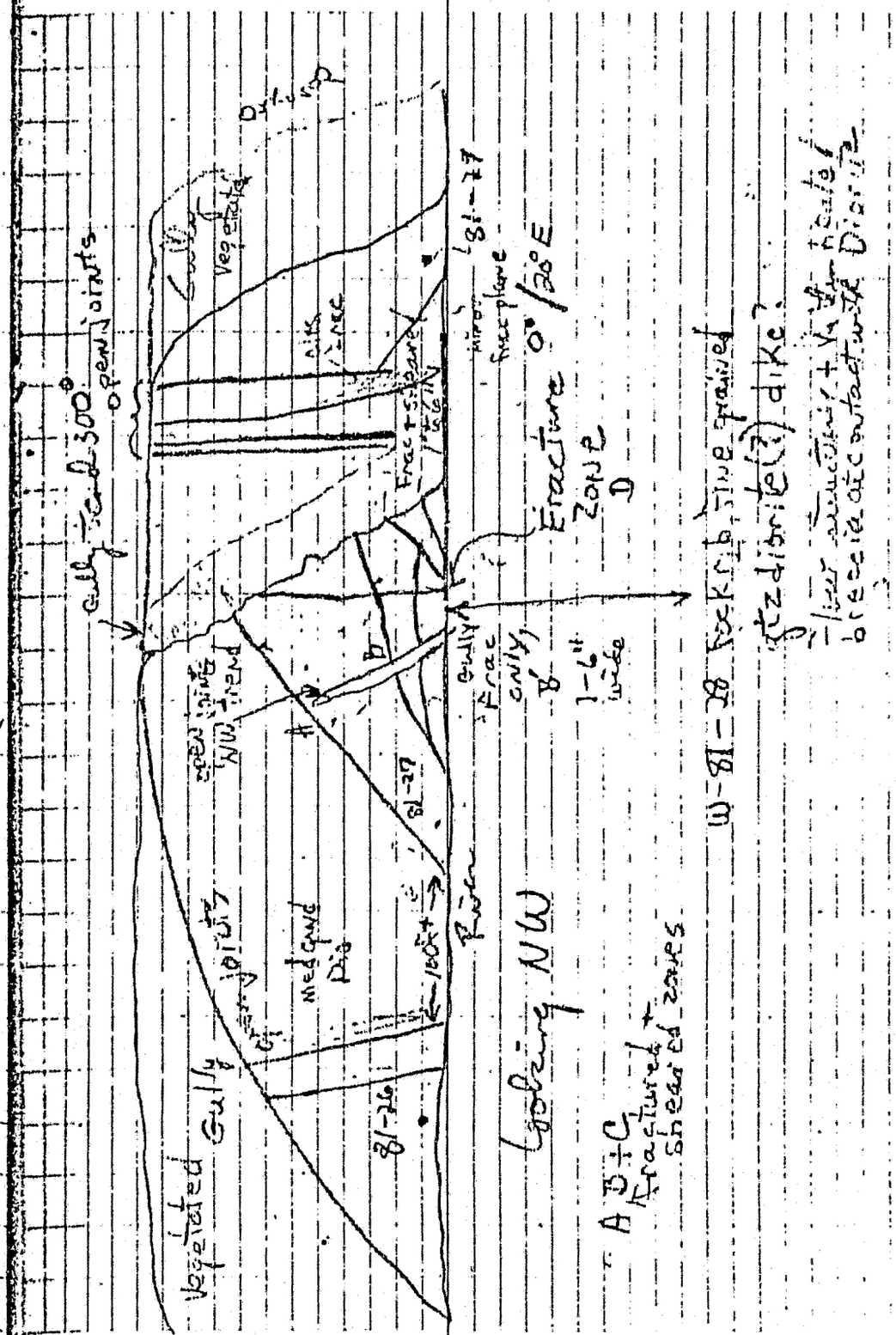
K3-14+15
Photos 14 + 15
View of fracture looking North

Potential for block failure along this zone and fracture zone in gully 100ft west

B another parallels the main zone 50 ft east
1 to 2" wide zone of fractured and shear rock, moderately to severely weathered
~338/40 SW surface is irregular
20.5

Joints offset across shear but do not appear to be rotated

Joints
Major O^2
O^2 - 5° / 65°E
Smooth, planar, some CO_3 coating
average spacing 6", slightly open



287
290/75N
Smooth, planar, slightly open, spacing 1-2ft

Minor 47
50°/16 SE
smooth, planar, spacing 2-3ft

47
50°/80NW
Smooth, planar, not continuous, spacing 6 to 1ft

W-81-28
Fine grained quartz diorite (?) dike?, grayish white, fresh hard, competent
West contact with diorite is healed, breccia 1-3 in wide east contact uncertain, probably gradational approx. 10ft of outcrop orientation unknown!
Sample W-81-28

Joints 297
300°/80°N
Smooth, planar to slightly curved, tight, spacing 3ft

347 350°/55°E
smooth, planar, slightly open, spacing 1 in to 1ft av. 6 in

50°/80SE
47
rough, irregular, not continuous, spacing 6 in to 1ft

alteration zone
Fracture zone (see sketch map), rock fractured along many v. closely spaced fractures, 340°/60W
severely weathered + oxidized
K3-16 Photo 16 closeup of zone
K3-17 Photo 17 from 100ft away

trend of zone is 337 340°/85W
Zone D
v. closely spaced fractures

Possible fracture zone (?) in rubble filled gully (based on topo) 215/90°

W-81-29
Diorite, med grnd, fresh hard, competent light gray, several dikes of fine grained diorite, 1 in to 2 in wide, minor inclusions of andesite(?) + fine grained diorite

Joints
Major
300-310°/85N to 80°S
297 Smooth, planar, few are slightly curved, spacing 2 to 10 ft, most are tight however, several are open up the entire cliff face (see sketch map) fracturing but no apparent shearing ✓

Minor
345 to 0°/70°E ✓
342 357 Smooth, planar, spacing 1 ft, tight

330°/35° SW
32 A Smooth, planar, not open

continuous, spacing approx 2 ft

0 to 20°/40 to 50 E
357 smooth, curved to planar not continuous, open, spacing 1 ft

Dike
45°/30° SE

Sample W-81-29

K3-17 Photo 18
open joints, NW trending

K3-17 Photos 17-25
25 Panorama of entire outcrop area

Marked on topo map areas of ground water flows

Possible [illegible] in rubble filled [illegible] 307 / 20(?)

Mapping at Devil Canyon has revealed numerous dikes downstream from the dam site. Because of accessibility due to poor ice conditions and deep snow it is unlikely that any mapping can be done during this winter field work.

Dikes approximate orientations

NW	chute
N	ridge
15°	ridge
N	
NW	

3/18 Sunny, 30°

KJW - Watana
MB - Devil Canyon

Upstream from W-81-29
North abutment
Groundwater flows noted on topo map. Two flows seem aligned across river (see map)

W-81-30 Fine to
Diorite, med. grnd, greenish gray, fresh, hard, competent, FeO staining on all surfaces, one well developed joint set, several 1 in to 10 in pluriodikes (275°/70N)
272

Joints
Major
310°/85°SW
Well developed, smooth to rough, planar to curved, open. Spacing 2-3 ft, one joint continuous through outcrop has localized shearing

90°/40 S (variable)
rough, irregular, spacing variable say 2 ft

Subhorizontal sheeting
rough, irregular surface

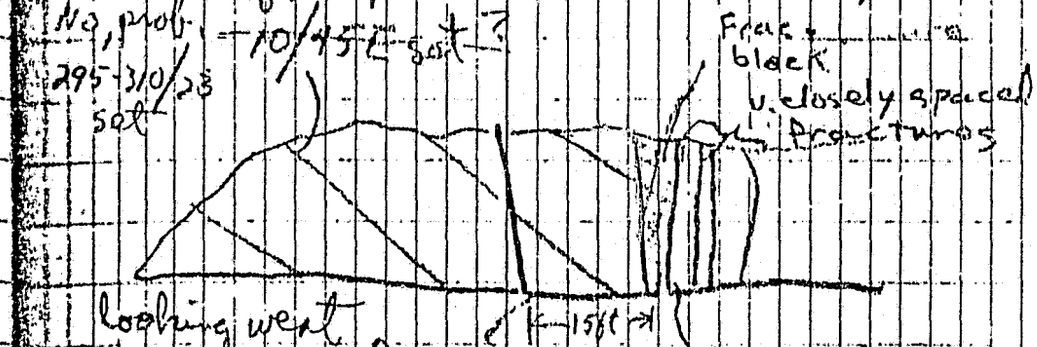
Station W-81-9
Sample W-81-9
Diorite

Joints
Major
300 to 315°/75°N
planar to irregular, generally rough, open, several fracture zones with possible shearing along the set
Spacing quite variable on outcrop say 1 to 5 ft

35/85 NW
planar, smooth to rough,

open, spacing 6" to 1 ft
295 to 310/23°N
smooth, planar, open
spacing 5 to 10 ft

10/45°E
irregular, rough, open, spacing highly variable over outcrop, 6" to 2 ft
spacing seems to decrease upward on the outcrop



Shear, 2 in wide, granular sand-size fragments severely wthd, orange
295/75N

Shear, about 2 in wide, granular sand size material
330°/80°S
sev. wthd orange

Photo K3-33, 34, 35

45°/80SE to 80NW
irregular, smooth to rough, open, spacing 6 in to 2 ft

Minor
20°/50W.
planar, smooth, tight, not continuous, spacing 4 to 6 ft

15°/35E
planar, smooth, not continuous, open to closed spacing variable 6 in to 3 ft

Subhorizontal stress relief not continuous, irregular, spacing 4 ft where present, open

W-81-31 Potential Joint Station
Diorite, fine tomed grnd, greenish gray, fresh, hard, competent, oxidized surface, two major joint sets give outcrop blocky appearance, several fine grained felsic dikes, no fractures between dikes and dio, trend 390°/85SW

Sample W-81-31 Diorite
W-81-31A Dike

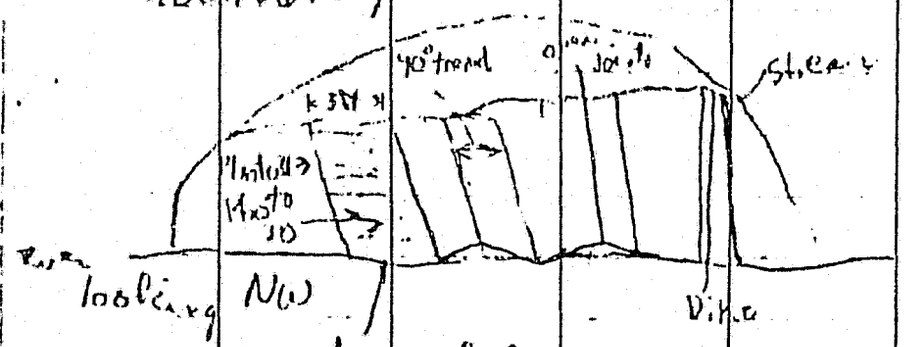
Joints
20 to 30°/40°E
17-27 (22) irregular to planar, rough, tight to open some frac where open, spacing 4-5 ft

Major
295 to 310/75 to 80 N
planar, smooth, open, spacing 1-2 ft
242-307 (300)

20 to 30/70 to 80 E
planar, smooth, tight, spacing 2" to 1 ft av 6"
17-27 (22)

No 330 set, unless 295/75 set is equivalent

Minor
90 / 70 to 80°N
87 smooth, planar, not continuous
spacing 3 to 10 ft, small (6 in.)
fracture/shear assoc with this trend
Photo 28
57-67 60-70° / 10-20° SE
smooth to slightly rough, planar
to wavy, not
continuous, spacing 2 to 4 ft
K3-26 + 27
Photo 26+27



Zone of very closely
spaced fractures, tight, bounded by
E-W set + 20°/40 E set see photo 32
K3-
26 Photo 28 dike and small shear
29 Photo 29 repeat of 26+27
30 Photo 30 closeup of tight fractured zone
32 Photo 32 looking NE at 20°/40 NE set
side of frac zone
31 Photo 31 NE

ground water flow up stream and
downstream of outcrop

Compare joints sets with other
outcrops for possible slide block

W-81-32
100-150 ft upstream of 81-31
Diorite

Joints No dominant set
267 270 / 80 N
smooth, planar closed to
slightly open spacing 1-2 ft

27-27 / 32 30 to 40 / 75°W
planar to curved, smooth,
open to closed, spacing 6" to 1 ft

32-32 / 32 315 to 335 / 80 N
planar, rough, tight
spacing 3 to 6 ft.

W-81-33
South abutment
first outcrop downstream of
the "Nob"

Sample W-81-33

Diorite, medium grnd, gry
fresh, hard, competent
two prominent joint sets,

Joints
Major
330 to 340 / 80 NE
planar to slightly irregular,
smooth to rough, spacing 2 to
10 ft, generally closed but
two open up entire face, one
has 1/2 inch to 1 in. sheared rock

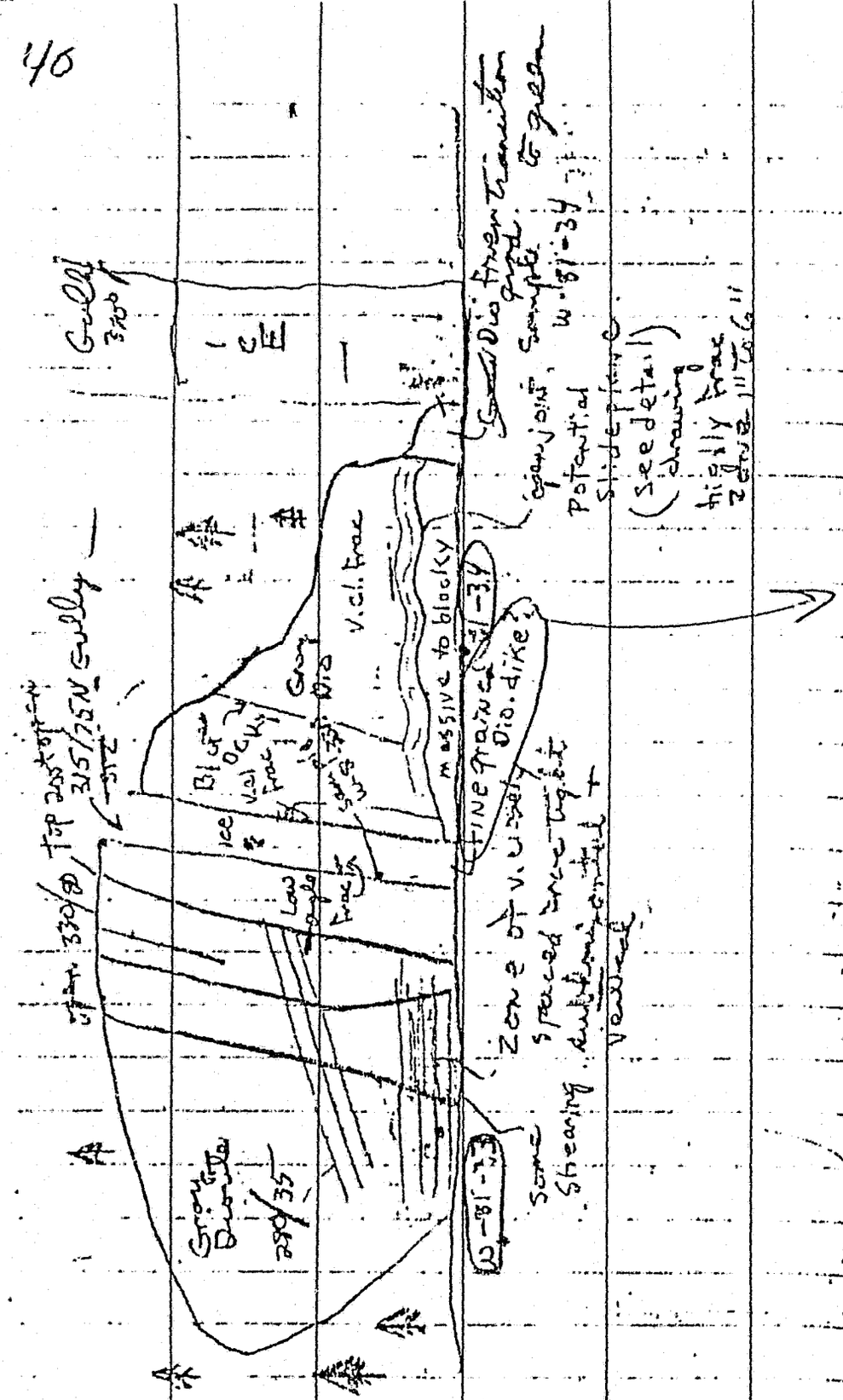
45 / 85 NW
parallel to outcrop, planar,
smooth, spacing 1 to 2 ft
tight

Minor
270 / 40 S
smooth, planar, not
continuous, tight, spacing
6 in to 3 ft

280 / 35 N?
orientation very uncertain
only exposures 15 ft up cliff
open & closed, planar to
irregular, dip out of face

Subhorizontal fractures
near base of cliff
closely spaced

In gully by topo
filled with cobble and
boulder size rubble, walls
on either side and particularly
west side fractured along
numerous very closely to closely
spaced fractures, tight;
weathering on walls more
intense, 40 to 50 ft up gully



low angle fracture zone (10°/12E surface irregular orientation approx., 2 in to 6 in wide fractured and possibly sheared (?)

Rock sample from east wall of gully W-81-33A darker, finer grained and less biotite and hbl than rock to either side, possibly dike?

W-81-34

100 ft west of 81-33
same diorite as 81-33 but also includes 1 ft wide zone of diorite breccia in andesitic groundmass
prob. formed late in plutons history, trend of zone is 35°/45SE

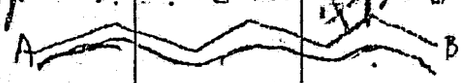
med grnd tends toward massive and larger blocks
fine grnd smaller blocks so easier to erode → gully.

most prominent joint sets:

A 295/32 N
planar to slightly curved, smooth, limonite stained, open, spacing 2" to 2ft

B 100/25 W
0 planar, smooth, open spacing 2 in to 1ft

Intersection of A & B
cause wavy joint pattern
approx orientation 50/20 NW



other joints (below "failure plane")
330/80 N
32 smooth, planar, closed, 1 to 5ft spacing
(above plane: open, 6 in to 1ft spacing

Minor
90/60 S
8 planar, rough, generally closed spacing 2" to 4ft not continuous

"failure plane" dies out into a fracture zone on the west side of outcrop in fine grained diorite. Jointing also changes abruptly two joint sets intersecting to give blocky appearance

Joints in fine grained diorite
Major
335/75 N
33 smooth, planar spacing variable 6 in to 1ft, open
47 50/75 NW
smooth, irregular, open, spacing 6 in to 1ft

Minor
320/25 SW
31 irregular, smooth, open not continuous thru outcrop ½ to 6 in spacing at end of failure plane

fracture zone
320 [illegible]

K3-3 Photo 36
looking SE at
"fault plane"

NE Photo 37
closeup of joints
A+B

Sample W-81-34
fine grnd diorite
from west end of
outcrop

Photos
K4-4 to 8
miscellaneous
aerial views
of DC.

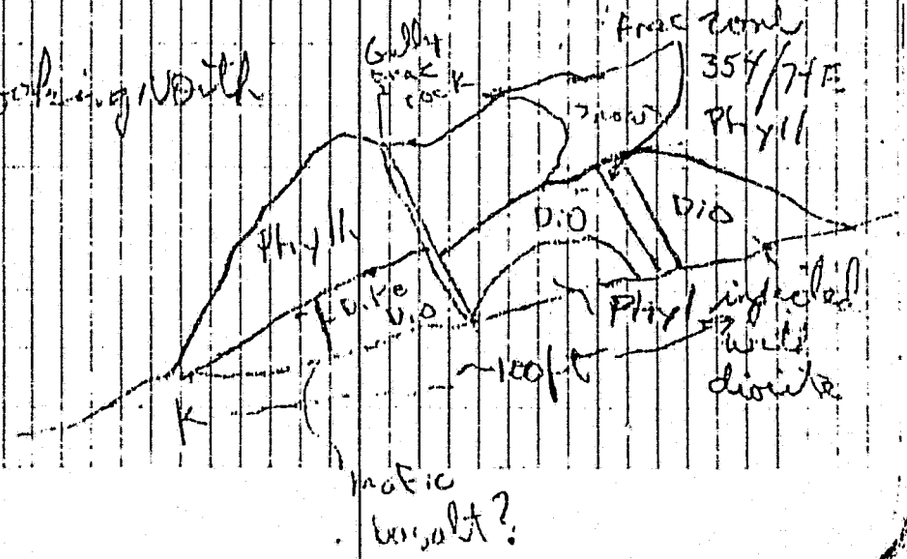
K4-1+2 Scenic
3/19 Ptly Sunny, 30 at Watana Camp
Snow at DC, and rain
enroute to Devil Canyon

Roll 4
K4-3 Photo 3
Oxidized zone on Tsusena
Creek

Cheechako Creek [#6, 79-83]
D81-14 argillite 280/85N
- to phyllite
Sample D81-14
phyllites → from finer seds (clays)
argillite → silts - fine sand

D-81-15
300 ft upstream
Contact area with diorite

looking North



Contact between argillite/phyllite + diorite where exposed is sharp with a thin frac. zone on either side. Probable orientation is 30/25° W (?)

Diorite, fine grnd, light gray possibly qtz diorite or granodiorite

Joints

Major 348/65 W
smooth, planar, generally open, spacing 6 in to 2 ft
frac + like parallel thin sil

35/20° E
smooth, planar, open, spacing 2-4 ft

Minor
0/62° W
smooth, planar, 1 to 2 ft, open

D-81-17
Photo of mafic dike
Photo 8

D-81-19 (Rain + snow)
upstream at plunge pool

granodiorite (?), light gray, fresh, hard

Joints
110/79 S
smooth, planar, spacing ~ 2 ft, open

110/71 N
planar, smooth
spacing 1 to 2 ft

187/90
planar, rough
spacing 2-3 ft

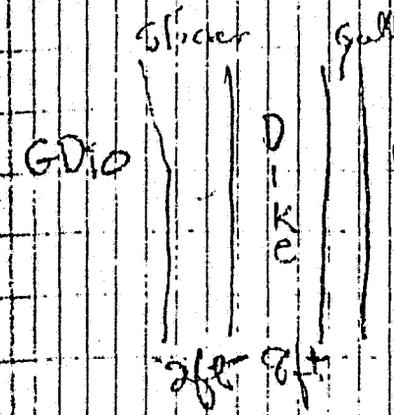
20/14 SE
irregular gouge
spacing 6" to 1 ft

Sample D-81-19

D-81-20
Shear zone
1.5 to 2 ft wide
Slicks on surfaces
303/84 SW to 60NE
dip on slicks 2.5 to 7° NW
60 face 2.5 to 7°
Movement to SE

Biotite granodiorite
crushed and mod to
rev wthd

Slicks on
65°/74 NW
slicks 12 NW



Gdio
Qtz vein by
joint (150/83 N)
1 to 4 in spacing

Joint in dike
65/64 SE
spacing 1/4 to 1/2"

- Mafic dike with [illegible]
some [illegible]
[illegible]

notch in [illegible]
[illegible]

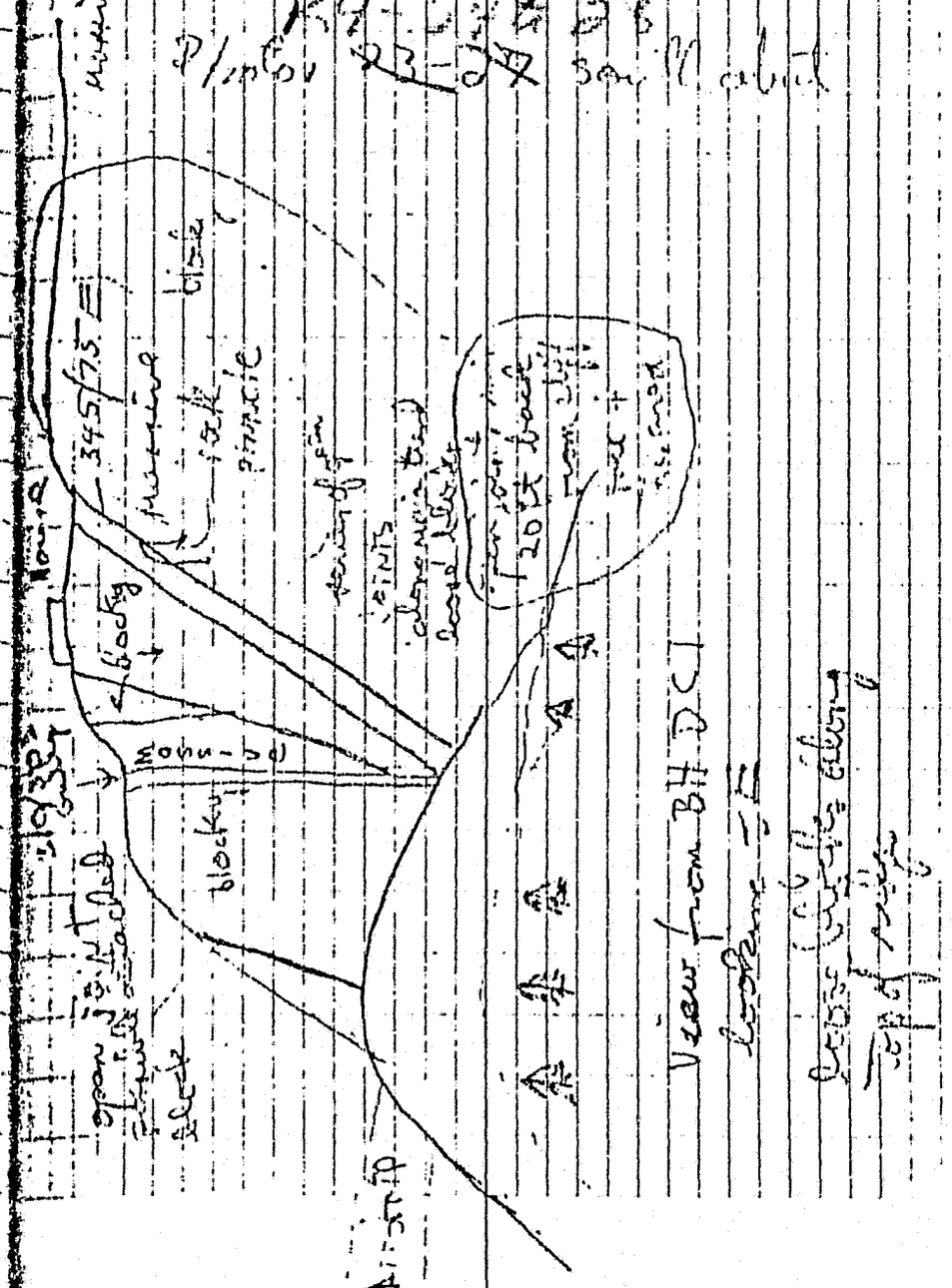
K4 11 Photo 11 looking
upstream at dike
D-81-17

K4 13+14 Photo ~~12+13~~
D-81-15

on Susitna upstream from "Reechako
[#6,83] D-81-21 argillite
aplitic dike
K4-15 Photo ~~14~~
Sample 81-21 dike
Sample 81-21 A
pebbly argillite

D-81-22 [#6,84]

AT BH DC1 North abutment
K4-16 to 23
Photos 15-22
Panorama east to
Southwest [illegible]
K4-[illegible] to 26
Photos ~~23-27~~ South abut



52 K4 30 to 33

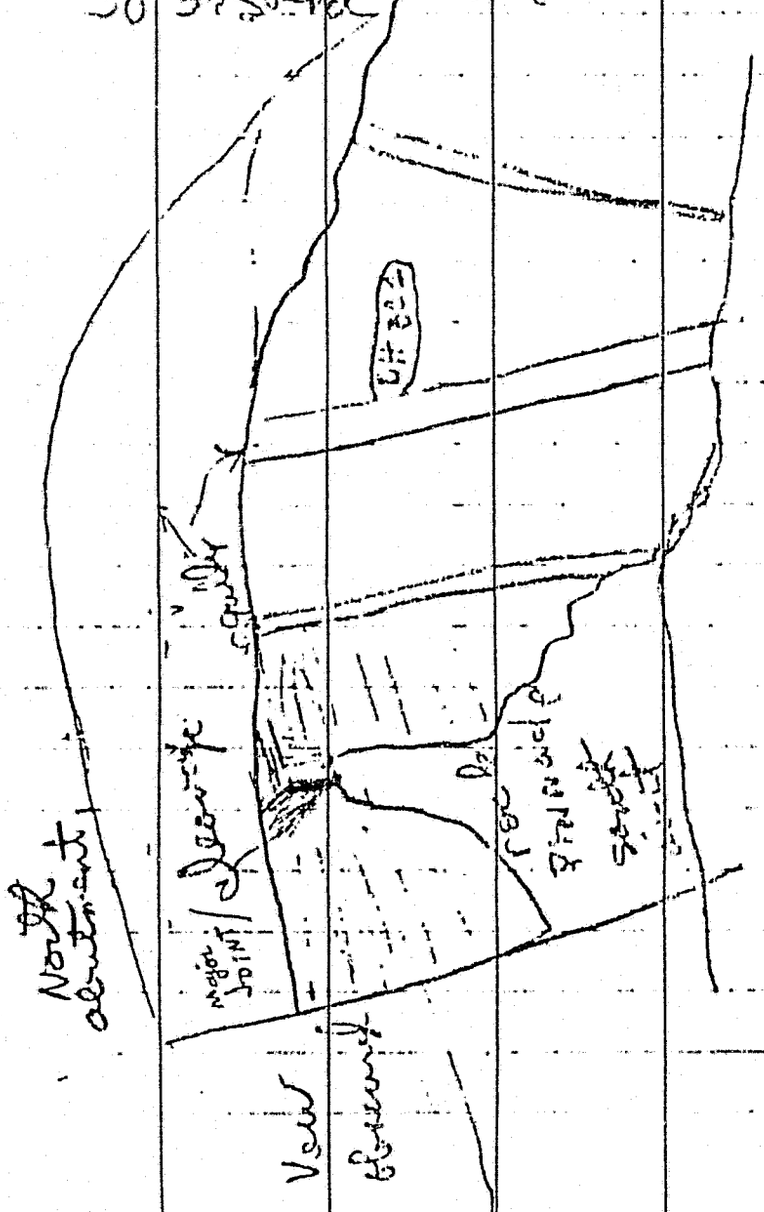
Photos 29-32

view of north abut from just west of major gully

34 ~~33~~-35 repeat

37 36 east corner of above shots

38 ~~37~~ bend arrive



Rolls 1, 2+3

53

K5 Photo 1, 2 view of canyon looking downstream

D-81-23 [#6,87]

Argillite, massive, dark gray, numerous folded qtz veins, well developed joints

Sample D-81-23

K5-4

Photo 3 of outcrop

Shear zone

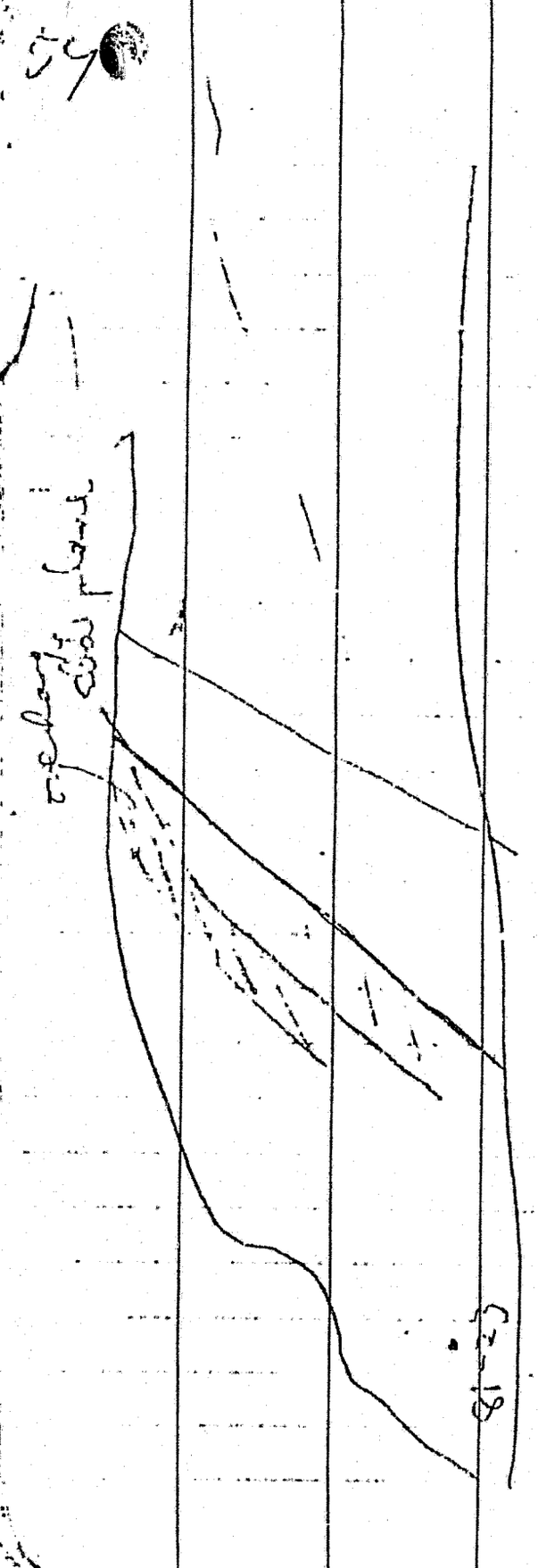
orientation 35°/65

slide block

fractured and crushed

rock zone 1 into 6 in

K5-5, 6+7 D-81-23, [illegible]



D-81-24 [#6,89]
Argillite, dark gray, fresh
with [illegible], [illegible]
folded [illegible], FeO
staining on [illegible] joints, hard
joints.

350/75-80 E
planar, [illegible]
rough, spacing 1/2 to 1 ft
possibly cleavage, [illegible]
of v. [illegible]

60/25 NW
planar to slightly irregular
smooth to rough,
spacing 3 in to 2 ft
not continuous, open up to 1 in

105/88 S
rough, irregular
spacing 3 to 6 in, FeO
stn, fluted

161/54 NE
smooth, planar
spacing 6 in to 2 ft,
open

qtz. parallel to and
crosscutting cleavage,
veins 1/4" to 6 in
generally fractured
sl. to mod. with d. argillite
around qtz. veins

~~Photo Map~~
K5-8 to 19
Photos 4-19
Misc. views from Hcpts
of Canyon + Cheerhaho
Creek

Notes to water

Photograph east face of the nob
" 81-31 and 81-34
Trace low angle frac on
81-31
Contacts at Fins

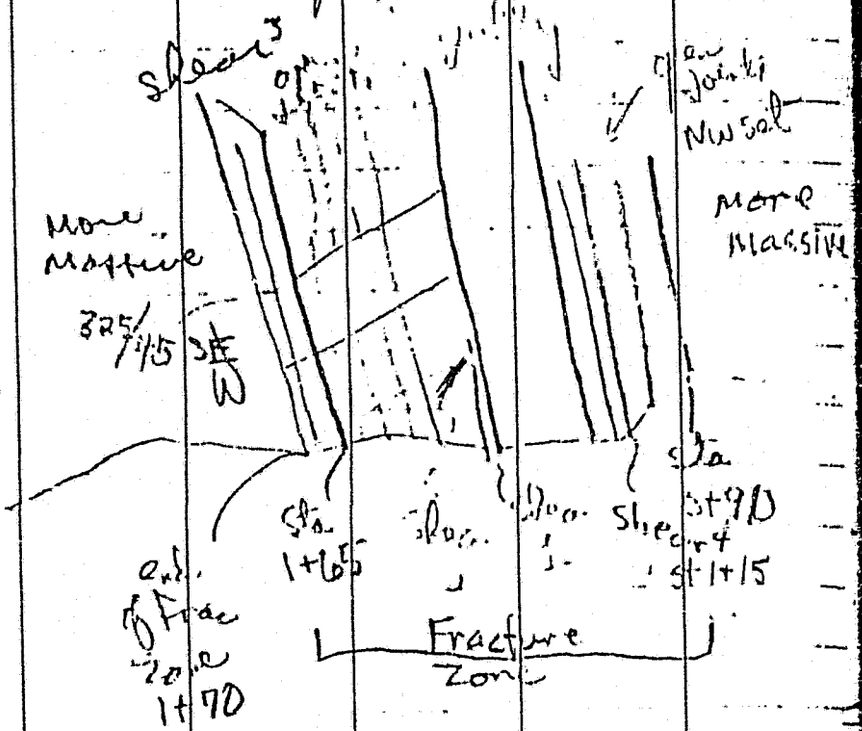
3/20 Watana NW
Sunny, mid 30's
D.C MB & JH

The Fins

Sta 1+20
Fracture zone
Four shears within fractured
rock zone.

Shear 1. ~~315~~ 312/75 N aligns with gully
0.6 to 0.8 ft wide
slightly oxidized shear
and crushed rock,
orange, severely with d.
K5-20 Photo ~~19~~ cleavage with
ruler, sta 1+20
granular, sand size material

Shear 2 335/75 SW sta 1+23
from 0.5 to 2 in wide
minor shear, sheared
and crushed rock,
orange, sev wthd



Fracture zone from station
0+90 to 1+70
NW joint set, open, spacing
2 in to 1 ft, planar

325/45 SE set, planar, smooth,
open, spacing 2 to 4 ft

Shear 3 sta 1+65
315/75 N
two wide wide, same material
as shear 1
Shear 4 Photo 20+21 K5-21-22
310/75 °N
4 in wide, same material
as shear 1
lineations in shear 1
and 2 parallel strike
Sta 1+15
K5-23 to 26
Photo 22-25
Fracture zone
K5-27 to 29
Photo 26-28
repeat of above
note markers at
sta 1+50 and 1+00

Contact between andesite and
diorite follows shear (?)
Sta 300 (andesite) to 3+20
(diorite)
Gully filled with ice up to
looks like shear w/ oxidized surface or
similar to others

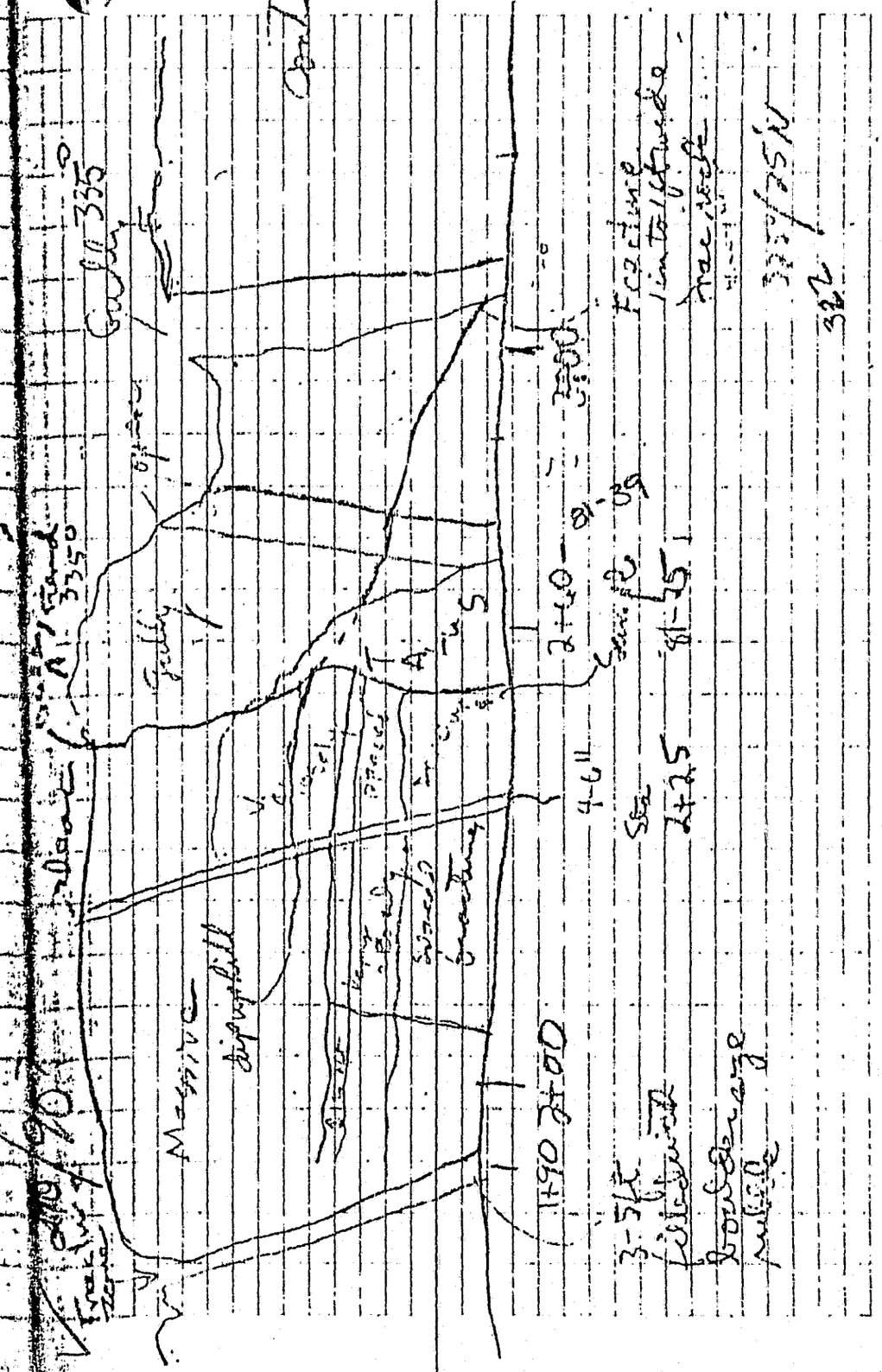
3/21 Work on maps in office

3/22 Work on maps in office

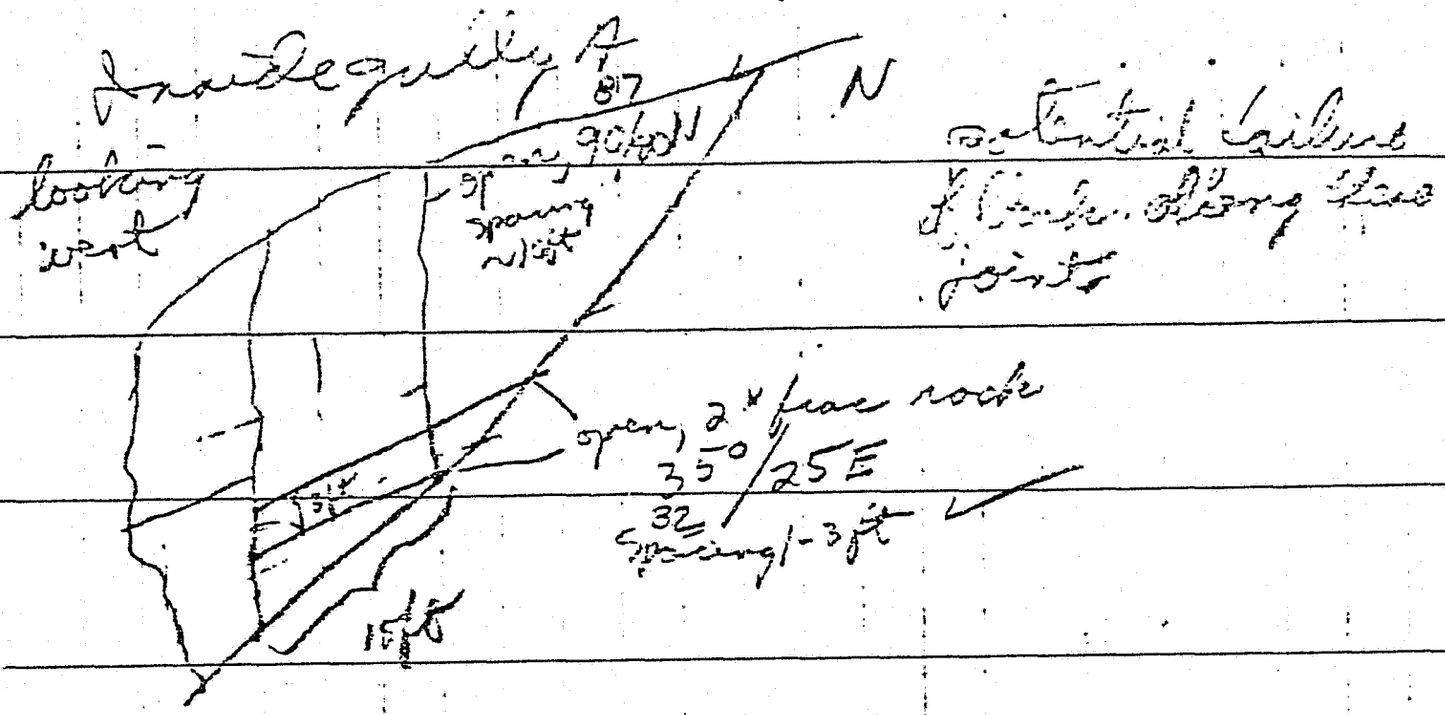
3/23 Return to camp
12:30 Waiana
Fingerburts

Site W-81-25 [#6,100]
Andesite Porphyry, gray green
No HW
flow structures
pronounced
inclusions of argillite
and gray diorite,
and andesite, argill — Kabulani, 1 to 3"
diorite - subrounded
1-3" dia
Plag phen to 1/8"
flow structure only
evident on weathered
surfaces

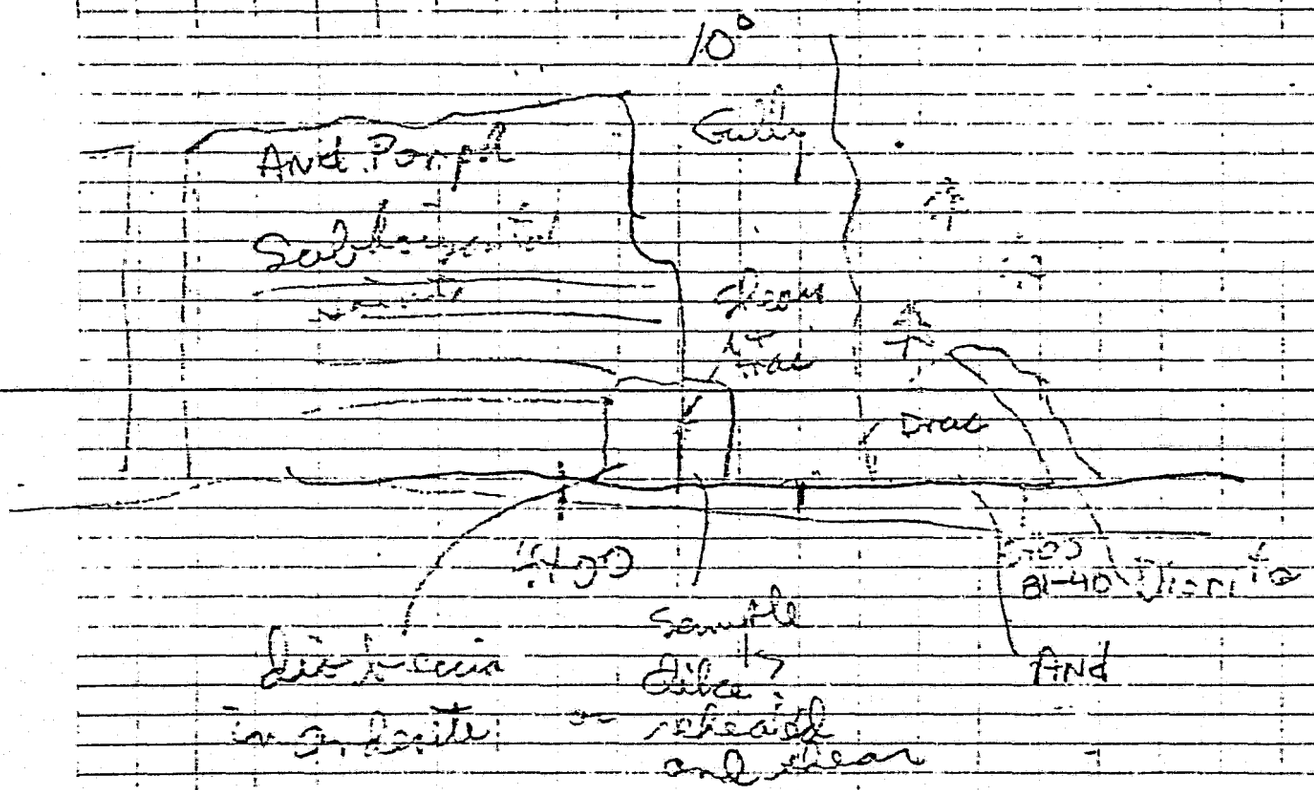
flow structures
subhorizontal


Gully
Gully
Massive
Diorite
Fracture
Fracture
Fracture

Inside gully A



potential failure of [illegible] along these joints



K-61-95 [illegible]

71

3/24 Ptly Sunny
at Watana

W-81-44
And. Porphyry
K6-12
Photo 12 outcrop

W-81-44 [#6,108]
Andesite Porphyry, green
plag phenocrysts less than
1/4 in, fresh
W-81-46+47 [#6,110]
W-81-47 [#6,111]
Andesite Porphyry
at river level
K6-13 [illegible] of volcanoclastics
talus of volcanoclastics
15 ft downstream
K6-14+15
Photo 13+14
contact of clastics
and andesite [illegible]

W-81-48 [#6,112]
Andesite, gray to reddish gray
porphyritic, weathering
rusty orange, generally
fresh to slightly weathered
rarely inclusions
Sample W-81-48A

Volcaniclastics, sand to
pebble size pieces
(sandstone + [illegible])
interbedded, beds 1 in to
6 in where visible
fresh to slightly weathered,
yellow gray weathering
with limonite on many
surfaces

~~Photo 13~~
~~looking along strike~~
~~of bedding~~

Shear zone A
fractured rock n. 5 to 6 ft
wide, v. closely to closely
spaced joints / two sheets
a) 1 inch wide (1/2 to 2 in)
silty sand, yellow
orange, 310/90

b) 2 inches wide
sand silty sand and
more frac. rock
310/90

slightly to moderately
[illegible]

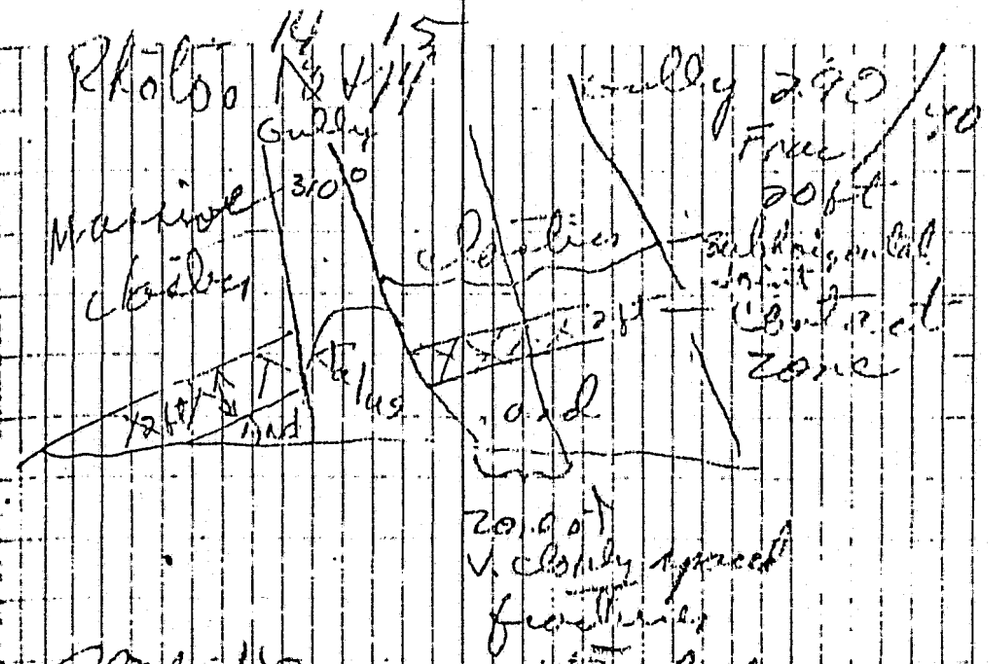


Photo 16 [illegible] 15 [illegible]
from island

50 ft above river level

Shear at 3+50 300/70N
Photos ~~29 + 30 + 31~~
K5-31 31+32 note brown wthd
vein/dike ?
sample Sta 3+50
Qtz + $CaCO_3$ weathers
rusty orange not
sheared but highly
fractured, 6" wide
parallel shear
also small veinlets (1/2")
which crosscut shear
where no Qtz vein
weathers to a fine
powder (clay/silt size)

K5-
Photo ~~32~~ 33
of upper N-S shear at 3+50
zone 3 ft wide, sev wthd
sheared rock

lower N-S shear 32
slickes trend 55°/50W
on face 20°/55W
slickes on $CaCO_3$ coating

also on 320°/60° SW surface
trending 230°

Probable slickes on N-S surface
but cannot reach in

Rock between upper and
lower shears has numerous
thin zones of sheared and
shattered rock parallel
to major NW joint set
K5-34 Photo ~~33~~

Sta 4+10
narrow fracture zone
3 ft wide fractured rock
approx 2 in sheared
and sev wthd rock, orange
305/90°
302

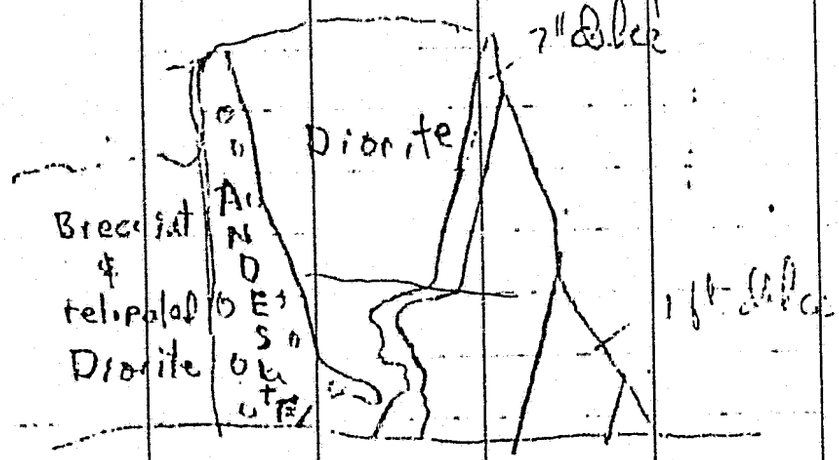
Sta. 4+50 Shear
320/65N
317 width varies from 16 to 2 ft, sheared rock [illegible] granule, yellow orange interlocked caught between [illegible] of [illegible]

W-81-5 Gray diorite
Sta 4+80 Also W-81-8
Shear
340/90
337 one contact covered [illegible] 3 ft sheared and fractured mod-severely altered sheared rock [illegible] brecciated granite [illegible] and rise pieces. fractured V. [illegible] speckled fresh, yellow orange

[illegible]
Shear
277 280/90
3 to 6 in wide sheared rock, granular and rise pieces weathered yellow gray
This is further [illegible] [illegible] [illegible] [illegible] [illegible]

Outcrop in gray diorite
Fracture [illegible] [illegible] [illegible] and [illegible]
Two [illegible] [illegible]
347/85W, 7" [illegible]
34 1 to 1 ft, greenish gray [illegible] [illegible] [illegible] [illegible]

7 in dike has been distorted (offset?) in area of andesite intrusion



K5-35 Photo 54
K15 36+37 scenic
Sample W-81-35
7" dike

Sta 5+00 to Talus

Sta 5+40 277 307
Shears? 280? and 310
Gully filled with ice covered talus, cannot climb, above talus rock is weathered yellow orange (typical of shears in this area) and appears sev. wthd, intersect of two zones like this assume two shears

Sta 5+90
Shear
277 280/70 S
Zone 1 to 2" wide sheared rock, sev wthd, soft limonite staining

Sta 6+60
W-81-36
Gray diorite
Several felsic dikes (1/4 to 6") as at 81-35 but different orientation 30°/50NW
light greenish gray,
dikes offset along tight jointing 305/70N, offset from less than 1 in to 6 in
Sample W-81-36
6+65 top of [illegible] just [illegible]
280/[illegible]

Sta 7+05
Fracture zone
305/75 N
Fractured and sheared (?) 6 to 12" wide, mod to sev wthd, limonite stain

Sta 7+30 shear
described earlier

W-81-37 332
fracture zone 335/90
15 ft wide, closely to v closely
spaced joints, gray diorite
mod wthd
May align with gully on
south side

Gully intersected by
280/90 frac zone
277 mod with ddio v. closely
spaced frac 2 ft
wide see topo

W-81-38
fracture zone, [illegible]
of 81-37, 50 ft wide,
mostly vegetated, prominent
indentation on major
zone bounded by two
planes 320/70 (SW) and
300/70N (NE), rock
between is closely
jointed, joints are open

trend with 81-37
lines up with gullys
on south side

Sta 6+65
Gully at 280°
typical condition of
shear zone
could not climb

Return to Anchorage

W-81-39 [#6,101], W-81-40 [#6,105]

Baseline Sta 8+50 W-81-41
outcrop 5½ x 10 W
Diorite, med grnd, green,
Biotite and Hbl(?), thin
weathered rind on surface
but fresh after 1 in.,
weathers grayish green,
thin qtz vein
Sample 8+50 Diorite
" qtz vein

Joints (outcrop too small
to pick major joint sets)

#290/80N most prominent
rough, irregular,
open and closed, spacing
6 in.

5 55/80SE
Spacing 6 in to 2 ft
rough, irregular,

3 325/25SW
generally planar, smooth
occ rough, 1 to 3 ft

3 0/70E (only one)
smooth to rough, slightly
curved, rock fractured
in a ½ to 2 in zone, some
CaCO3 veins

5 60/40SE
Planar to irregular,
rough, spacing 6 in to
2 ft

Sta 7+70 to 816 W-81-42
boundary, [illegible]
Diorite, med grnd
green, fractured
along [illegible]
closely spaced joints,

on ice survey line

Joints

Major
15/65-70 E
generally planar, smooth,
spacing 1 to 2 ft, open,

28 Sta 90/70 N
smooth, planar,
open, spacing 1 to 2 ft

57-67 60 to 110/40 SE
planar to curved, smooth
spacing 6" to 3 ft, open

15/90 open
Planar to curved, rough,
spacing 1 to 1.5 ft
KC-11
Photo of outcrop

Station 7+30 W-81-43

Diorite, fine to med grnd,
green

Joints
Major
10/80 E
planar to irregular, open
smooth to rough, spacing
generally 6 in to 1 ft
but 1 in places where
fract and mod weathering
occur, white stain,
possible shearing in these
areas

300 / 65 N ✓
smooth, planar, open
spacing 1 to 2 ft, open

Minor
282 285 / 40 S (approx) ✓
irregular, rough
spacing 6 in to 1 ft
open

277 28 / 48 N ✓
planar, smooth, open,
spacing 1 ft

Sta 6+95 to 7+10
Gully (Seismic line 80-1?)
bottom half covered
with rubble, approx
100 vert ft up, open
vertical joints, closely
spaced
strike 5° parallel ✓
to major jt set at
previous outcrop

climb up approx 100 vert
shear zone
sandy clay gouge, yellow orange
6" to 1 ft wide ✓
321 330° / 75 N
trends across gully

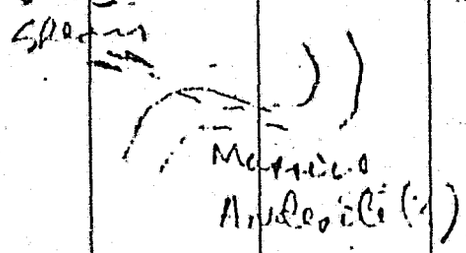
Fracture zone parallel to
gully 5 ft w of above
v closely spaced frac.

Approx 200 V feet above
outcrop at 730
rock in gully (20 ft wide)
v. closely frac, mod to sev
wthd, most cancelled by
yellow orange silty sand

Shearing (?)
6 in wide zone of
crushed and sev wthd
rock yellow orange
[illegible] silty sand,
[illegible]
strike approx 295 / 90 ✓
242

this bear parallel joint set that strikes across gully, blocks peel off and slide straight down.
also N-S joints along gully trend

Shears align with rive



Sample
W-81-40 5+20 diorite
4+90 andesite
4+30 dike or reheated andesite (?)
4+20 andesite with diorite inc.

Contact zone of andesite / Diorite at 5+10.
Andesite pods ~2 in appear within diorite also small veins of diorite in andesite.

Take orientation of gullies at ~3+20
4+20

W-81-49 50ft
across river from
81-48
Andesite / volcaniclastic?
light gray, sl to mod weathered,
plag phenocrysts, weathering
may give granular appearance
sample W-81-49

two fracture zones of
very closely spaced joints
slightly weathered, 10ft
apart

Joints
Major
300/70 SW
planar, smooth,
spacing 6 in to 3ft,
av 1ft, v. close in dcm,
open, fracture
parallel this set

65/80 SE
planar to curved, smooth
to rough, 2 to 3ft

350/75 E
planar to slightly curved,
smooth, open, spacing
2 in to 1ft, v. close in fracture
zones
45/75
planar, smooth
spacing av 1ft, open

40 to 60/20 SW
stress relief, irregular
rough, 1/2 to 6 in, av
2 in, open

Minor
~70/25 SE
curved, rough, spacing
6 in to 1ft

outcrop limonite stained
and has recall fractured
appearance
some $CaCO_3$ veins and staining

W-81-50 + 51 [#6,114-115]

W-81-52
Andesite, medium gray
boundary with previous
lithology seems gradational
over ~10 to 20 ft. Could
be that weathered phenocrysts
in 81-49 gave elastic
appearance, no
phenocrysts at 81-52

Rock broken along
closely to v. closely
spaced joints

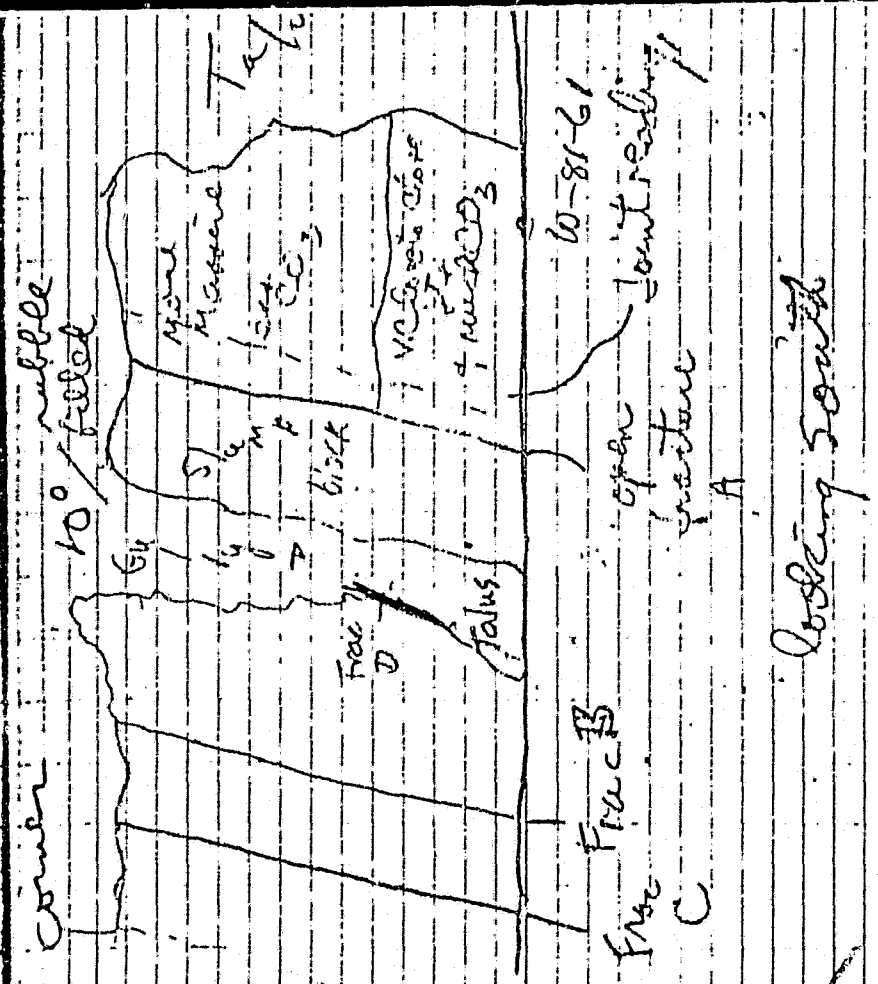
W-81-53 [#6,116]

W-81-54 [#6,117]
Diorite Breccia in Andesite Porph
matrix, 50 to 75% diorite
cobbles to Gimmax, gray diorite
subrounded to subangular, green
andesite
Shear zone
340/75°N
4 ft wide zone of fractured
and sheared rock, three
shears 3 in to 1 ft wide
crushed and highly
frac rocks, gouge
with yellow orange
crushed rock white (Cu?)
stain, silt and sand
size particles in shears

W-81-55 [#6,118]
end Porph
sample W-81-55

Photos 46-22
Panorama of Fingerbuster from west to east
W-81-56 to 60 [#6, 118]
W-81-61
Cliff face upstream from Fingerbuster and on south shore

Diorite, dark green, fine to med. grnd, biotite, no Hbl fresh, outer surface wtl to grayish green, $CaCO_3$ veins and nodules common along joints, white, mostly on west end (75 ft) west end rock broken along numerous close to v. close joints. no apparent sets except for subhorizontal sets



Approx Joint sets
65/75SE
planar to irregular, smooth, generally closed, spacing av 1 ft except in more frac zones where av 2 in.

Fracture A
325/80N
irregular, rough surface
open, to 6 in, appears
to be slump block,
approx 1 ft wide zone
of closely spaced frac parallel
to strike. Frac continues thru A
Gully A

Fracture B
340/85N to 90
1 to 3 ft wide zone, open
irregular surface, filled
with loose boulders

Frac C
355/80N
open 4 in to 1 ft, filled
with loose boulders +
cobbles, slump block?

Frac D
340/70 NE
open, 1 ft wide, loose cobbles
and soil

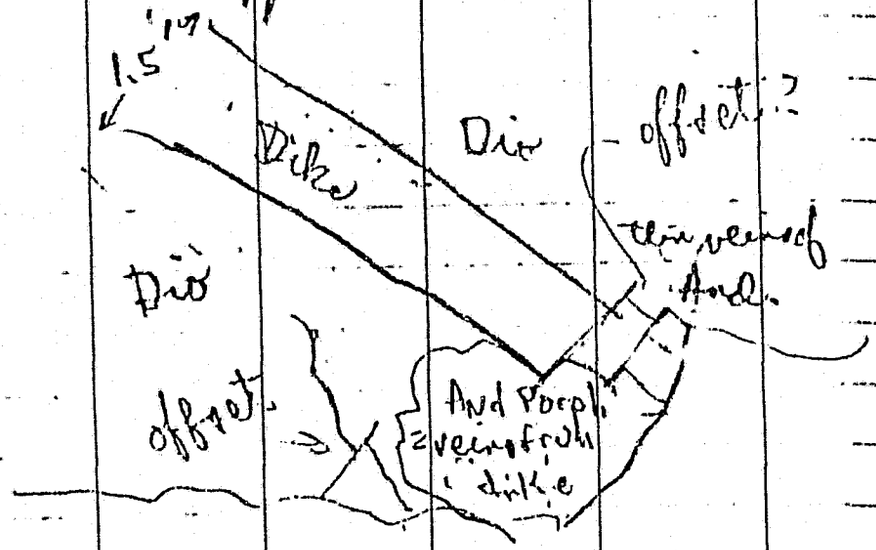
Joints (Contd)
325 to 340/70NE
generally planar and smooth,
spacing av 6 in, many open
Subhorizontal
irregular, rough, spacing
quite variable, zones of 2 to 6 in,
other spacings 5 to 10 ft

280/50 N (both variable)
planar to curved, smooth to
rough, spacing av 2 ft

W-81-62 at intersection of east and NW faces

Diorite, dark green, fresh, fine to med grnd as at previous stato. jointing somewhat better defined, much less CO_3 filling and staining

Dike
37 40/35 NW (approx)
dike has layered appearance



Felsic? (light colored, but with biotite, fine diorite?) intruded into an area of an andesite dike. felsic dike has "chilled" border at contact with andesite and diorite. Veins of felsic material in andesite

Photo 23 56-24

Small vein offset by joint
295/68S, 2.5 in

Dike appears to be offset along same trend

Sample W-81-62

Joints

Major

330 / 80 NE to 90 ✓
3 irregular, rough, open, spacing av 2 ft

70 / 85 S ✓
6 planar, smooth, some open, spacing av 1 ft

10 / 80 W ✓
planar, some curved, smooth, generally closed, spacing 1 to 4 ft

Minor

270 / 50 S
planar to curved, smooth, spacing 6" to 1 ft, generally 1 ft

280 / 50 N
planar to slightly curved rough, spacing 2-3 ft

Note 3/25 Viewing these from upstream

Contact with [illegible] approx on east side of gully at beginning of outcrop W-81-61 trend of gully ~335° Contact may trend slightly west of this to align with contact in Fingerbuster

they [illegible] on the face and are potential failure planes. Several areas on the slope can be seen where blocks have slipped down this surface

Estimated time to Complete Mapping

Southside of River	1 day	Wed
3 Joint Sta	26 1 day	Thurs
Tsusena	27 1 day	Fri
Devil Canyon	28 1 day	Sat
Misc	29 1 day	Sun
Office	30 1	Mon
Core	1	Tues

3/25 Sunny, 20's to 30's

Fingerbuster
Gully at 5+40

two trends 335 and 0°

W-81-63
Center of gully at
split of two trends
Rock appears to be
a rehealed breccia
of Diorite (Andesite?)
been refractured.
Pieces of diorite in a

diorite or andesite groundmass.
Rock is moderately wthd and
fractured along numerous
velsely to closely spaced joints
wthd surface is light greenish
gray.

Sample W-81-63-1

Jointing is irregular but
the NW and NE trends are
discernable, also E-W

Dike of light, fine
grnd granodiorite on
east side of ridge between
trends, width?, at least 2 ft
orientation 330?/90?
329

in contact with sheared
diorite with within veins
of andesite, some veins
in granodiorite at contact.

Sample W-81-~~63~~ 63-2 dike

outcrops higher up
to be checked in spring

ok

K6-26
Photo ~~25~~
Sta 5+10 contact
Diorite / Andesite

On south side
W-81-64

K6-27+28
Photos ~~26~~ ~~27~~
1/2 inch qtz vein offset
along reheated shear
287 (300/645)
trend of dike is 45/90
amt of offset varies
from 1 in to 8 in

Same shear trend as
dike at 81-62

Shears reheated with

green mineral, prob. chlorite

K6-27
Photo ~~28~~ ~~29~~
looking downstream
from 81-64 at
E-W/50N joints
potential failure planes

K6-30
Photo ~~29~~
Gully at 81-64

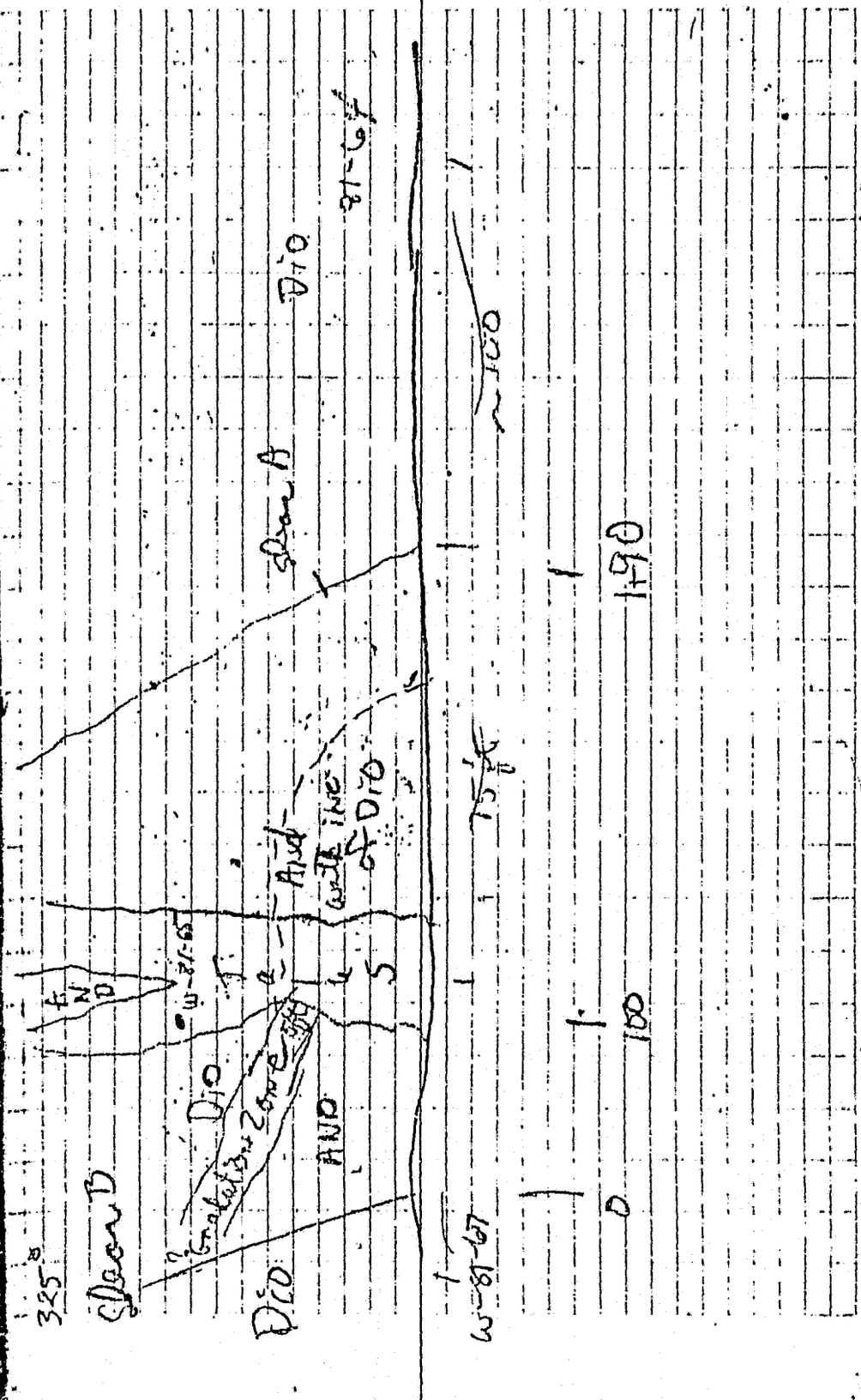
Diorite, dark green, fine to
medium grnd, fresh,
numerous qtz veins and
dikes of granodiorite(?)
generally less than 1 in
oriented.
27 30/75W linear gdiv?
62 65/90 linear " ?
~ 290/65 , irreg, qtz
287

Numerous areas of joints reheated
by andesite? or chlorite?

Shear? zone A
1.5 ft wide, 340/90
filled with, sandy silt
yellow orange, similar
to other shear zones

Rock upstream side of shear ∥ dio
then andesite with inclusions
of diorite up to 6 in, usually
rounded but some angular
dike?

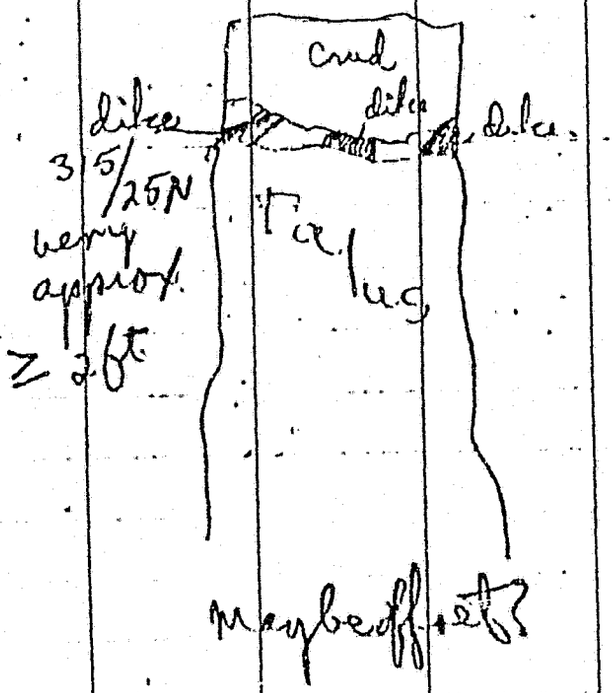
May be several dikes?
of andesite running thru
outcrop but cannot
determine orientation



W-81-67 [#6, 29
Up gully oriented 10°

Diorite, fine grained (almost anderite) ~~dark~~ gray, generally fresh, locally broken along closely spaced joints

Three exposures of dikes cannot tell of the vein due to crud on outcrop



dikes are yellowish white, fined grained, quartzite
Sample W-81-67 dike

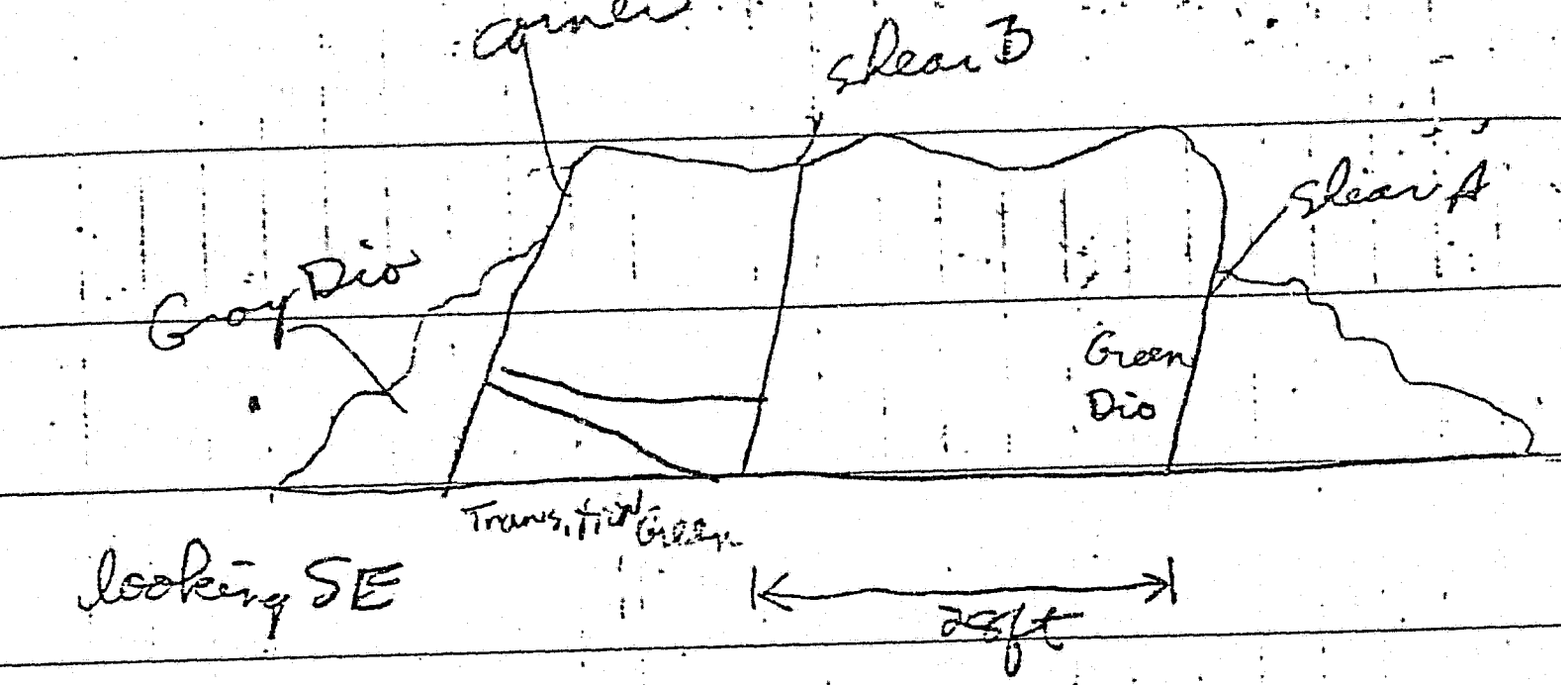
Sample W-81-67A diorite

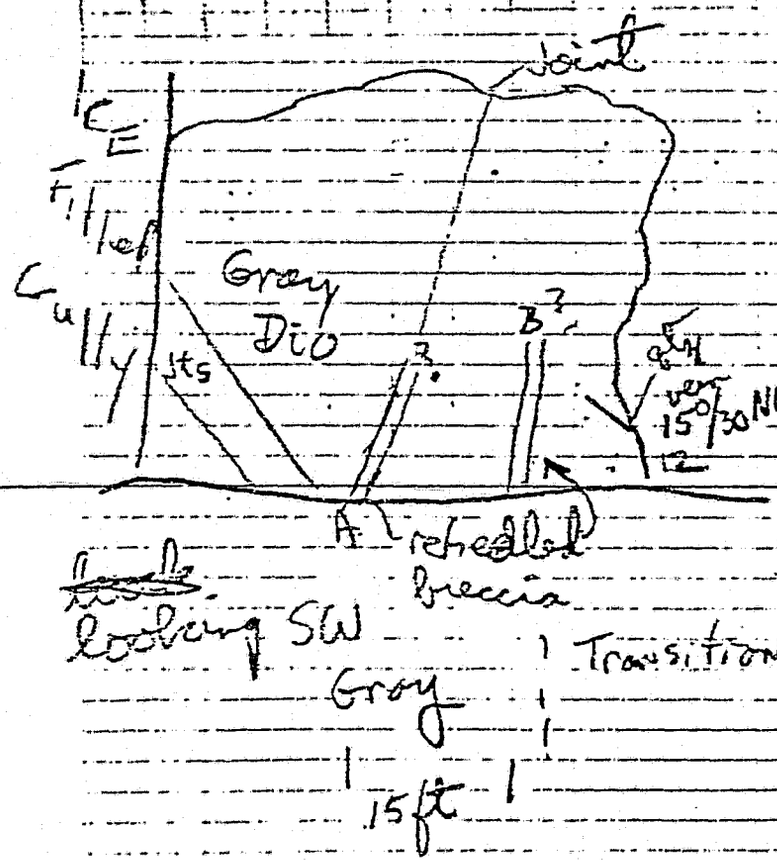
Photos 30-39
Panorama of W-81-29 to 39 area

W-81-68
Transition from Green to Gray diorite

West end
Diorite, med. grd, grayish green fresh well developed jointing, blocky.
Sample W-81-68A
two shear zones

irregular subhorizontal jointing





East end

Dikelet trend and rehealed breccia
Rehealed breccia
Dikelet trend
Rehealed breccia
Dikelet trend
Rehealed breccia
Dikelet trend

Transition from Gray to green is a zone of about 20 ft, assume that corner of outcrop is "contact"

Sample W-81-68C

Reheated Breccia Zone A

K6-36+37

Photos 35+36

Outcrop looking SE

New Roll No. K7

K71 OK K72+3

Photos 1 ~~NG~~ 2+3 ~~NG~~ OK

K7-4+5 same as 35+36

W-81-68+69 [#6,130]

W-81-~~69~~70

Diorite, gray, medium grnd ~~dk~~ dso greenish gray, well defined jointing, fresh beneath thin rusty wthd surface

Shear zones

A See M Bruen's book

B 287 290/50S, 6 in zone of fractured and crushed rock, gouge is silty sand, yellow orange, mod to sev wthd

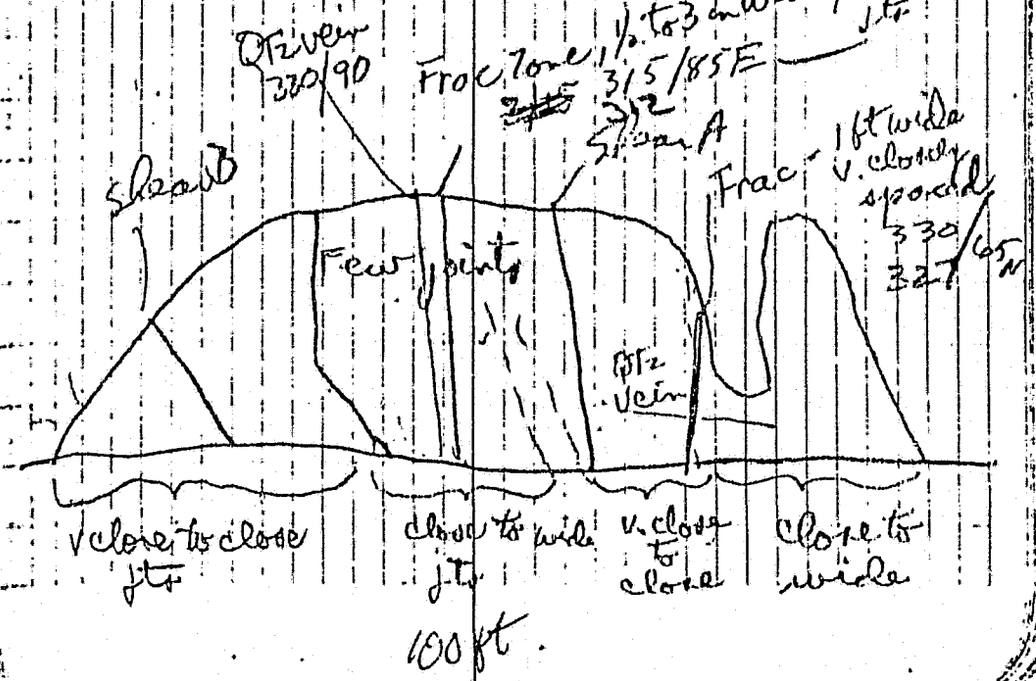


Photo 7 outcrop

Joints

Major 311

314/90 to 80NE

planar, rough, spacing 1 to 4 ft, ab 1½ ft

42 45/90

irregular, rough spacing 8 in to 2 ft, ov 1 ft

Minor

86/33 to 42 S

83 planar, rough

Spacing 6 in to 1.5 ft

335/45 to 50 SW

332 planar, smooth to rough

Spacing 8 in to 4 ft, ov

W-81-71 ~125 ft upstream of 70

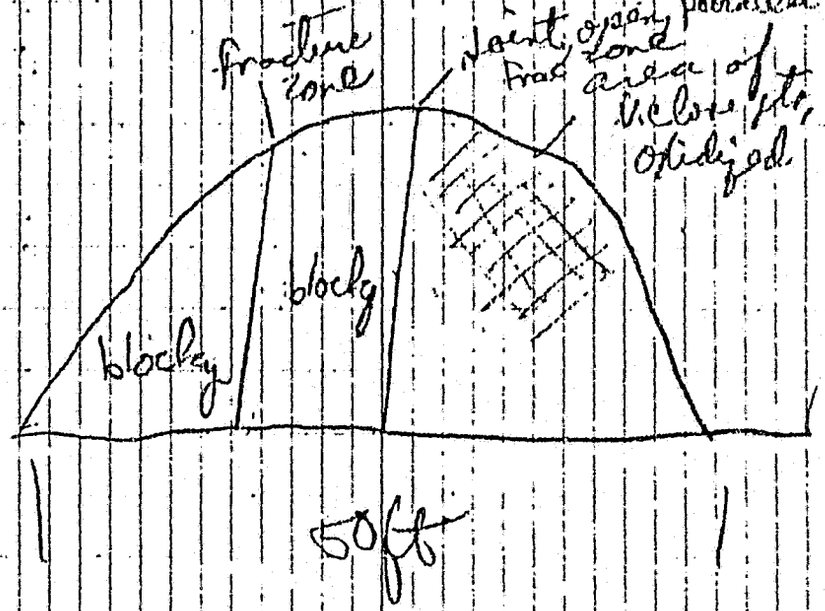
Diorite, grayish green, med grained, fresh, outcrop has fractured appearance, mostly v. closely to closely spaced joints, open, one fracture zone.

[#6,136]

Fracture zone

10 in to 2 ft wide zone of very closely spaced jts 310/80 N, no shearing

307



Joints
Major
310/82N
30 planar, smooth, open
+ closed, spacing 3 in to
1.5 ft
parallels frac. zone

55/88NW
52 planar, smooth, occ rough
spacing 1 to 2 ft

Minor
0/75E
35 planar, smooth, 6 in to 1 ft
where present, only in
fractured areas

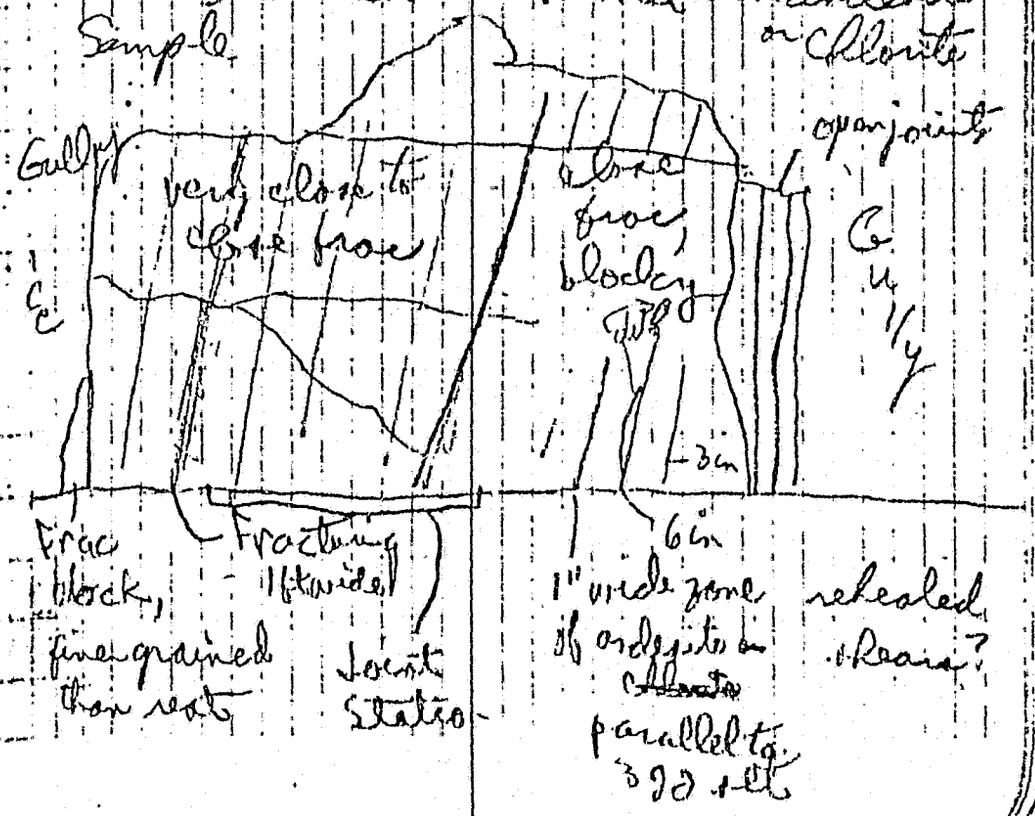
315/35N
312 planar, smooth, open,
spacing 6 in to 3 ft

K7-8 Photo 6 outcrop

W-81-72+73 [#6,136]

W-81-74 (D)
downstream from 81-34
bounded by two gullies
~150 ft.

Diorite, green, med grnd,
fresh, thin weathered surface,
v. closely spaced frac near
gully on east, zones of
v. closely spaced frac, generally
well defined jointing, blocky
several zones from 1/4 to 6 in wide of
rehealed shears either with andesite
or chlorite



Joints
Major
320/75 NE
planar to slightly curved, smooth, spacing 6 in to 3 ft av 1 ft
some 2 in to 1 ft wide zones of closely spaced fractures with this set

15/85 W
12 planar, smooth, rough
av 6 in spacing

Subhorizontal
irregular, rough,

~~Minor~~
II 60/65 SE
51 planar to slightly curved
spacing 1 to 2 ft

II 65/75 NW
62 planar to slightly curved, smooth, spacing av 1 ft

the last two sets are predominant on the west bluff side of the outcrop where the face of the outcrop is ~60°

West end of outcrop
3 ft wide zone of open joints parallel to 320° set
block may be slumping into gully

KY-1 Photo 9 W-81-34
KY-10, 11 Photos 10+11 W-81-D 14

Felsic Dike along 6 in rehealed shear appears to have been sheared + pinched out, pieces of felsic material caught up in shear, No trend, dike on vert face

W-81-E75

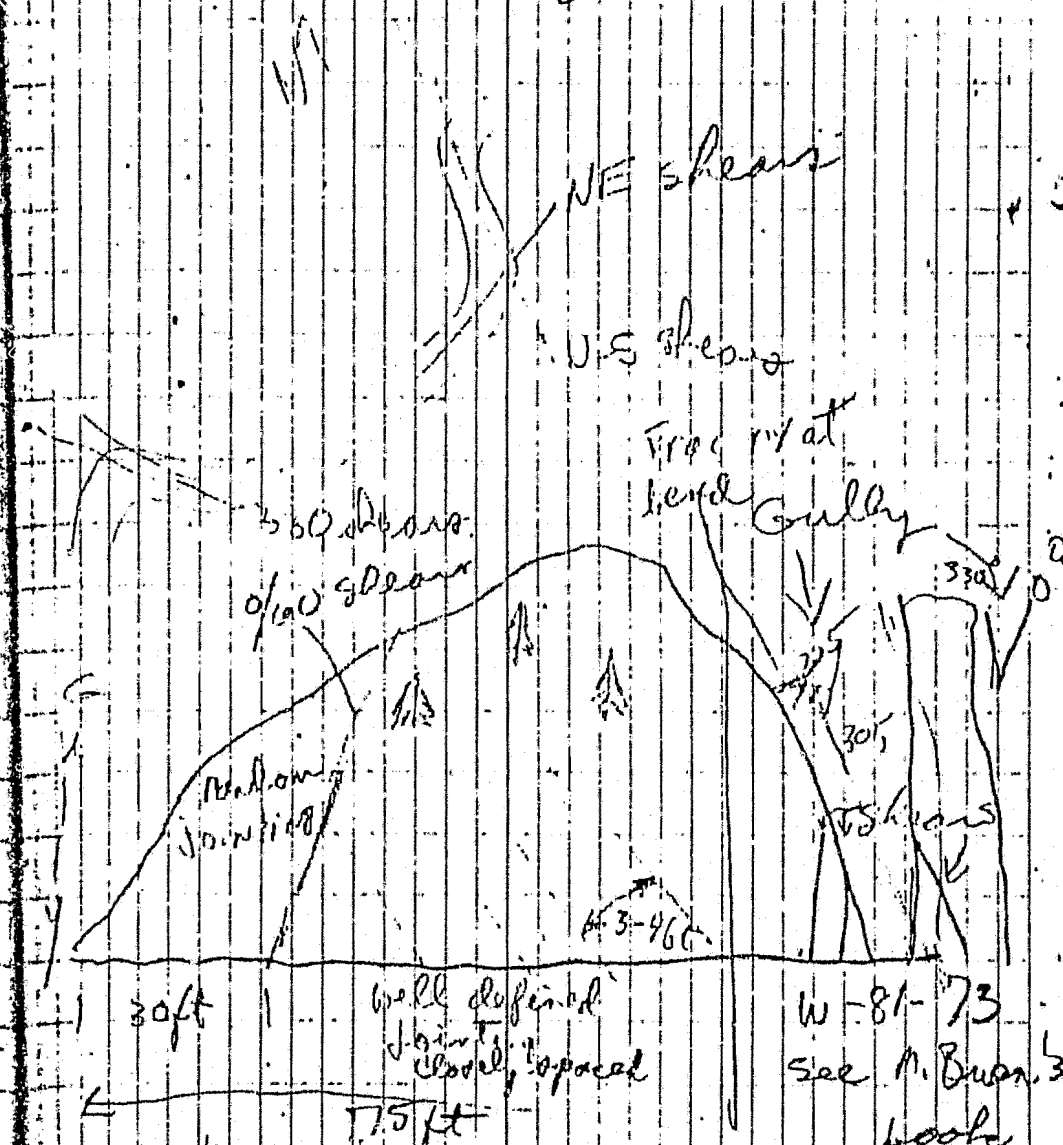
Diorite, green, med grnd, generally fresh, but slightly weathered to sev wthd in shear zones, closely spaced jointing except near shears

Shear zone
3 to 6 ft wide
357 0/60 E, zone bounded by two shears, 6 in to 1 ft of crushed & fract. rock, sev wthd to silty sand, yellow orange, between shears rock is v. closely to closely frac.

same strike as shear set in Fins but opposite dip direction

Sample 81 E 75 diorite

Pick up time - finish tomorrow



3/26 Cldy, some snowflurries, 20's

Joint station at Fingerbuster
[#6, 141]
3+30 to 380
W J-9
150 jts

✓

K1 - Photos 12+13
looking across river from fingerbuster lot
Diorite Exposure

K1 - Photo 14 ✓
W-81-27
possible offset of joints, no amount or sense of movement, but joints ~~do~~ are not continuous across shear
Joint survey at centerline
W-81-26
[#6, 147]

W-81-33
inclusions of fine grnd green dio

W-81-~~D~~ 74
Joint station ✓
some gray dio with green
K7-15 ~~to~~
Photos ~~14~~-18
Outcrops 81-75 to 81-72
[#8, 1]

3/27 - Snow 20's
Deep Powder Snowshoeing

Tusena Creek
going upstream

W-81-76 [#8,7]
See airphoto

Andesite with inclusions of light diorite to 1/2 diameter. Outcrop is sl to mod wthd, approx 10 ft wide to 6 high.
Some question as to whether it is actually "in place"

W-81-77 [#8,8]

W-81-78 [#8,10]
NW side
Volcanic conglomerate of diorite (white) in a matrix of andesite, approx 80% diorite
Boulders and cobbles to 2 ft diameter, most 2 to 6 in subrounded poorly defined jointing prob due to the cobbles and boulders, fracturing along cobble boundaries
Shear zone
A 314/75 NE
6 in to 1 ft wide, crushed and frac rock, silty sand, yellow orange, unfractured qtz vein runs down center of shear

Rock on either side is sl to sev wthd, generally matrix is most wthd

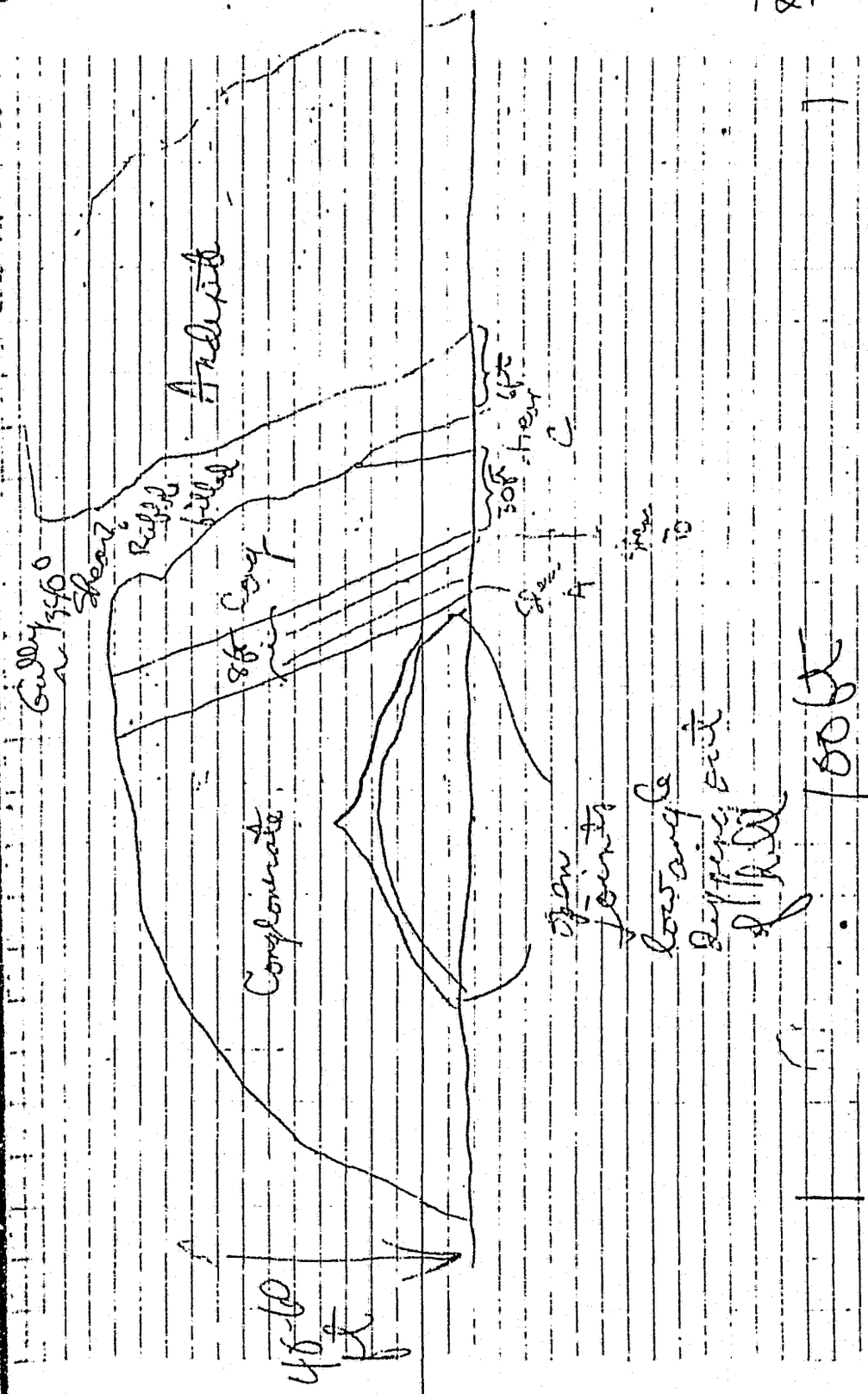
~~Sample W-81~~

B Shear 321/80NE & 90
18 in to 2 ft wide
mostly filled with
snow and ice, but
seems to be sheared
like A, that is yellow
silty sand

width of zone bounded
by shears is 8 ft

East side of outcrop
is greenish gray,
andesite

NE side
Andesite
grayish green, fresh
well defined jointing



Sample W-81-77
from just up stream
of outcrop

W-81-78
altered zone ~300 ft wide

From east end

at very end
Biotite granodiorite, 10%
quartz, biotite and Hbl(?)
~~[illegible]~~ Phenocrysts to 1/2 in
mostly fresh but
weathering increases
as I go west

K[illegible] = 1[illegible] + [illegible]

Photo 22 closeup of
weathered zone in
shear D
severely wthd sand
size grains
weathering and material
similar to that as in the
major shear in Fine

Rock on east side is
generally severely wthd
several places where
wth is just beginning
Light gray with fine to aphanitic
groundmass of qtz feldspar
plag phenocrysts approx 1/4 inch
qtz "eyes" to 1/2 in (10% of sample)
less than 1% mafics if any generally
although some "zones" where
mafics to 10%
Sample W-81-78A

Where weathered which is
95% of the outcrop, mod. to

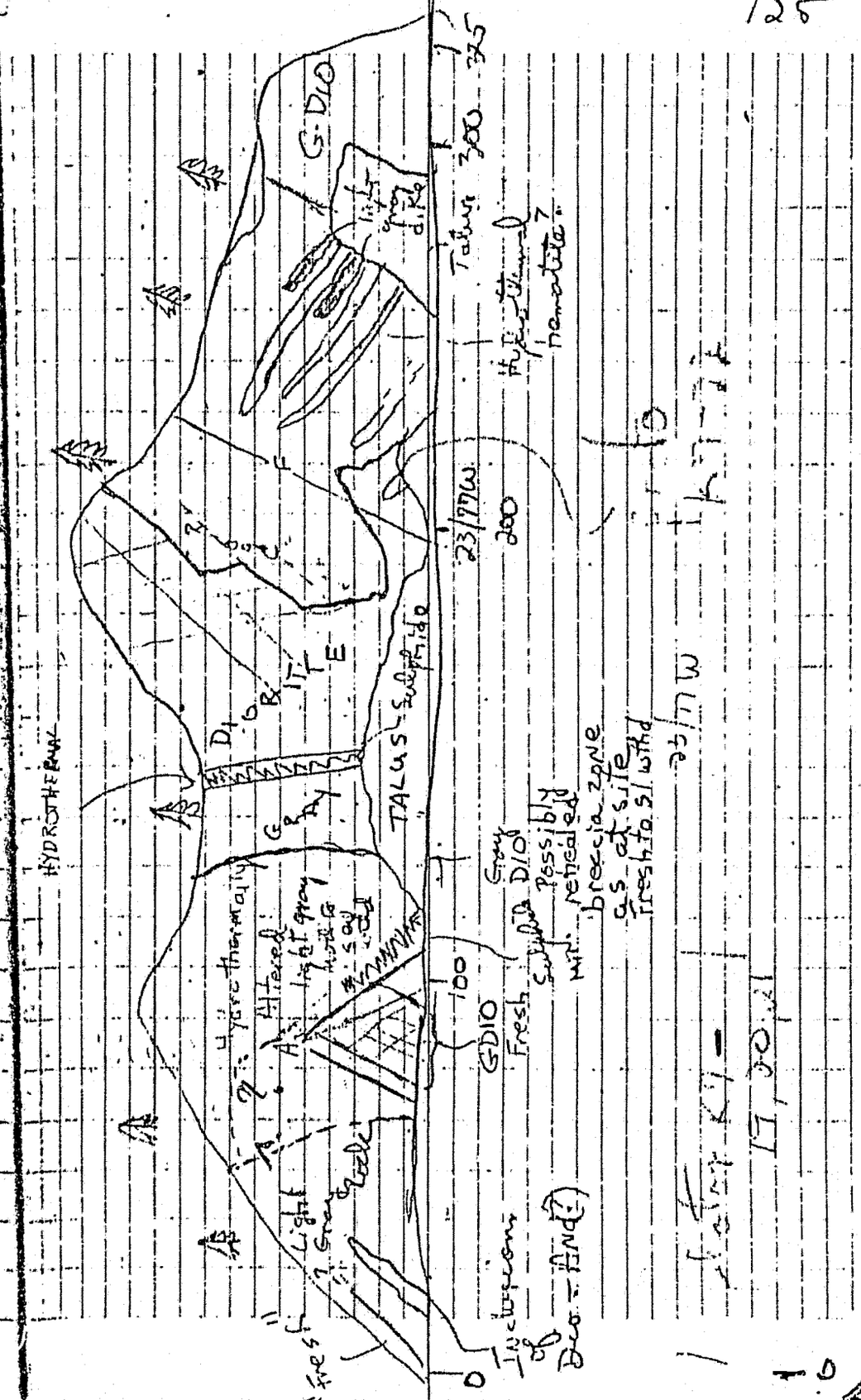
sev wthd, plag wthd to kaolinite (Sample W-81-78B

Zone of inclusions of biotite diorite and andesite (?)

Shear Zone E
Sulphid mineralization
Sample W-81-78C
yellow to black staining and hydrothermal alteration, pyrite, sulphurous odor

the area above this is mod to sev wthd, rusty colored

Gray diorite, fairly sharp contact with hydrothermal zone, inclusions of andesite many areas where the diorite appears to be a reheated breccia zone



that is with 1 to 2 inch pieces of diorite in a matrix of andesite/chorite
Diorite is distinctly unaltered in places although two vertical zones of sulphur mineralization do cut across it
ranges from massive to closely fractured

An orange wthd ridge runs above the and to the east of the diorite cannot sample may be either diorite or G dio, ~~jointing is~~

East of the ~~ridge~~ ridge the structure is markedly different
Jointing is more pronounced particularly the 280/72N set. these joints strike up to the ridge and then end. this set occurs in the west end as well but not in the middle portion of

280/72N slicks 14°W

Parallel to these joints are zones of hydrothermal (?) alteration approx. 2 to 3 ft wide, cored with hematite stain and surrounded by a 4 to 6 in bleached zone.
Six of these zones occur on the face and end at the ridge or shortly before it (where the jointing ends). Rock within the zones is severely wthd.
Some reverse fault and shearing has also occurred in these (actually due more to the jointing?)
Qtz veins crosscutting the zones have been offset from 1 to 2 inches from reverse faulting.
Also athlas slip movement, ~~[illegible]~~ slicks on 280/72 joints dip 14°W
Photo ~~24~~ Closeup of zone
K7-23 showing offset qtz vein

this zone also has what appear to be layer, dikes?, of the light gray rock found at the west end also parallel to the 280 set, approx 3 to 5 ft wide

To the east across a ~~[illegible]~~ talus filled gully the rest of the exposure is granodiorite discussed earlier, v. close to closely fractured
Sample W-81-78D
W-81-79 [#8, 15]
Walked upstream 1/2 mile - granodiorite like at east end of above outcrop

Collected sample WCC 2 from site ~~[illegible]~~ east of river - Tertiary volcanics

Sample WCC 3 from ~~[illegible]~~ upstream on river at Tertiary(?) volcanics next to fault

[#8, 16]

[illegible]

3/27 Ptly Sunny
Quarry A

W-81-79
Andesite, moderately wthd, dark green, plag phenocrysts to 1/4 inch
Sample W-81-79
nearly horizontal flow structures
Similar to that on river?

W-81-80
Diorite Breccia, 60 to 70% diorite pebbles to cobbles, gray diorite, in andesite matrix, pieces up to 6 inches subrounded, mod wthd
May have been mapped previously as diorite
Sample 81-80

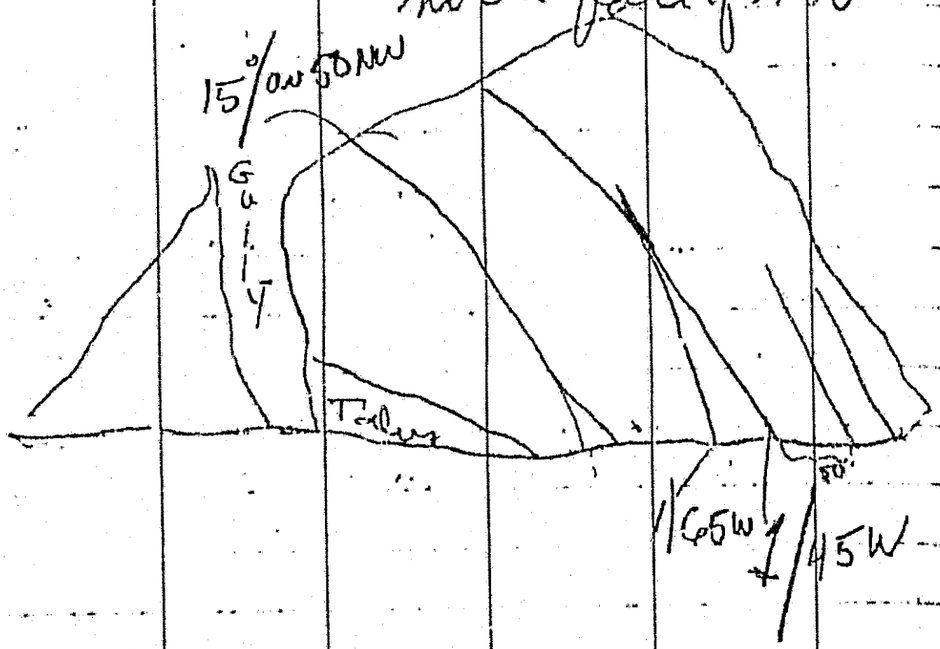
W-81-81
Andesite/Dacite?, volcanic anyway, dark gray, numerous plag phenocrysts to 1/8 inch
Sample W-81-81
Question as to whether this is the same flow as seen on the river as unconformably overlying those flows + diorite?
Volcanics form distinctive knolls above valley floor

W-81-82
Rhyodacite, light gray phenocrysts of plag + qtz (10%?) to 5mm, sl wthd
Sample W-81-82

Same jt sets as at other stations NE, NW, EW

W-81-83
Andesite / Dacite, medium gray, plag phenocrysts, dl. wthd
Sample W 81-83

Photos [illegible] to 31
north face of nob



W 81-84
off 400 scale mgs on airphoto, northshore, gray diorite, medium grnd, fresh

PM Devil Canyon
[illegible] upstream of lineament through [illegible] lakes, north side
DC-81-32 [#8, 20]
Argillite / Phyllite, dark gray, fresh, some cleavage or schistosity present but not well developed, ~~[illegible]~~ where present qtz veins are complexly and tightly folded on a scale of inches, reason for lack of good cleavage

DC-81-A Sample

DC-81-B

Downstream of 32 Argillite/Phyllite, dark gray fresh, w/ surface black, some thin beds of sandy matl. (Meta Graywack) Sand grains are stretched. At least two episodes of folding can be seen in the outcrop: broader folds (335/63 SE) wavelength of 30 or more (30) feet, no schistosity, ~~but~~ these have been folded by other folds (280/35 W) with wavelengths of of 1 to > 10 ft

first outcrop after vegetated area

Cleavage ~ 70/75 S (approx due to folding)

Going downstream sandy beds become more prevalent several areas of rythmically alternating sand and clay in what may be a Bouma type sequence of flysch deposition. ~~Out~~ is a erosional ~~layer~~ surface overlain by sand with ripple marks, grading upward to shale. Fairly good exposure of this indicates beds are overturned

Bedding + cleavage 20/55E

~~Up is to~~

Stratigraphic top (up) is to the West

Beds 1 to 3 inches

Shale

Sand

Shale

K7 - Photo 32 looking along strike to N, handle points "up"

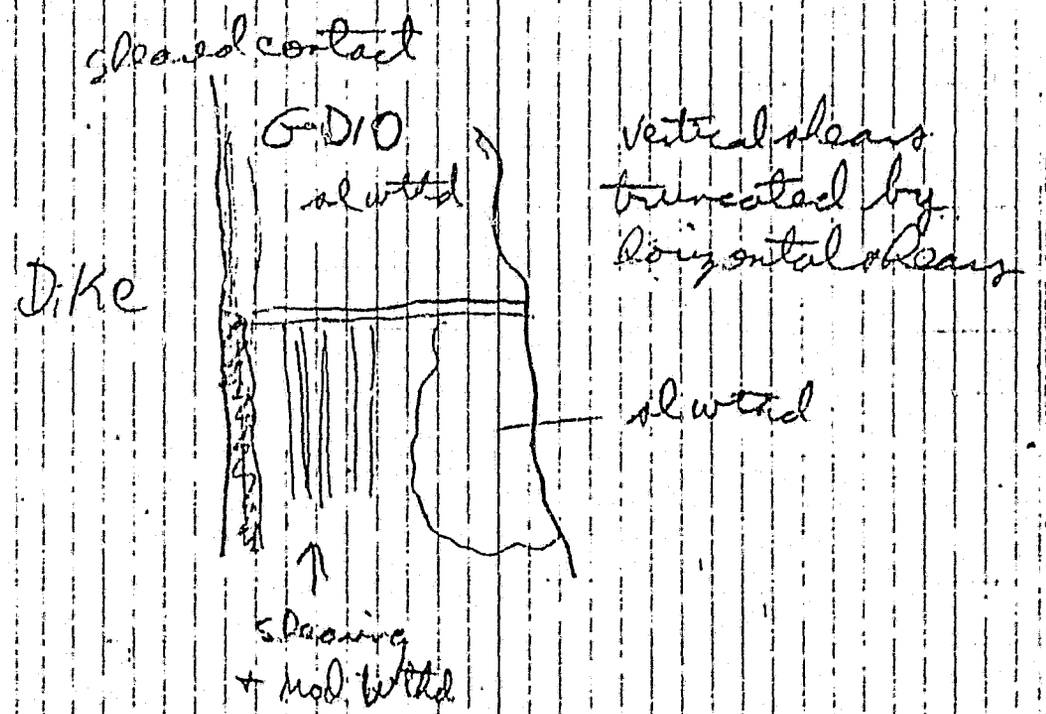
D-81-34 [#8,21]
Cheerhako Creek
upstream of where we
left off two weeks ago
see all photos

Granodiorite, grayish
white, fresh to moderately
wthd, most wthd in shear
zones, 30 to 40% quartz,
biotite 20 to 30% weathering
to chlorite along shears, Outcrops
frac along well defined joints

Dike (330/90), mafic
diabase, sheared along
contact with Gdio,
dark green, 25 to 35 ft,
lines up with gully
across ~~the~~ creek

many zones of shearing and
mod wth.

Shears (325 to 337/80 SE or NW to 90)



Jointing in dike and GDIO
~~the~~ same

Sample D-81-34A GDIO
D-81-34B Dike (diabase)

two sets of slicks
see book 8

Outcrops of argillite upstream beds overturned, graded see book 8
Sample

DC-81-35 [#8,23]
+36

Devil Canyon

DC-81-37 South abutment
[#8,24]
Argillite / Rhyllite, dark gray to black, highly deformed multiple cleavage planes no predominant foliation, boulders of qtz and thin ss beds, massive, hard competent, few joints, weathered out pyrite cube holes to 1/2 in, few minor qtz veins generally less than 1/2 inch, not continuous due to stretching, ~50 ft upstream bedding better defined, appear right way up.

Joints see book 8

K81-Photo 34
looking downstream
shear(?) on north side
~ 300 ft from corner
Appears open to 2 ft
some oxidation see map

Sample D-81-37

Rock in DC changes from argillite to slate to phyllite depending on location with respect to fold axes, local folds and the intrusions
Where all cleavages parallel rock is slaty to phyllitic,

Argillitic texture ie no schistosity from multiple foliations & none of which

predominate which gives a massive appearance

3/28 Sunny, 20's

D-81-38 [#8,26]
Downstream of site
at bend in river (see airphoto
~~[illegible]~~ approx 1.5 mi

Argillite/Phyllite, dark
gray to black, foliation present
but not well defined, may
parallel bedding, minor
secondary cleavage, rock
is fresh, hard & competent
few joints, weathered ~~[illegible]~~ out
[illegible]ite/arsenopyrite
~~[illegible]~~ possible slumping of some
blocks to river
rock has overall massive appearance

Joints
Major
325/72 NE ✓
plane, smooth
Spacing 3 in to 3 ft or 1 ft
tight

[illegible]/18°S
plane to irregular, rough
6 in to 2 ft

18/86 W
2 in to ≥ 1.5 ft
sl irregular, smooth,
parallel to fabrication
Major

Minor
72/83 N
planar, smooth to rough
spacing as 1 ft

Bedding?
55/37°SE
some parallel jointing
discontinuous, spacing as 6 ft
rough, irregular

Sample D-81-38

Possible secondary cleavage
S_2 = 55/70 S340/75°N

D-81-39 [#8,27]
Sandy argillite interbedded with
graywacke
argillite same as at 81-38
but with more sand
Graywacke, med gray
to light gray on wtd surfaces
fresh, hard, beds to 5 ft(?)
hard to tell because of
gradations + vegetation [illegible]
stretched sand size grains
some pyrite
Sample D-81-39
minor [illegible] qtz veins

Joints in book 8

fracturing + possible shearing
parallel to bedding joints
at north end of [illegible]
cut

2 to 6 in wide, may be just
slump block

D-81-40
Argillite, dark gray, fresh, some limonite stn., outcrop has massive appearance, with few well defined joints

Joints
182/48S bedding + foliation, v thin, smooth, planar, discontinuous

Major 315/58NE fracture cleavage spacing 1/4 in to 6 in, planar, smooth

Wolverine downstream from us.

Major 52/58SE
planar, smooth, av 1 ft

333/78NE
plane to slightly curved, smooth 1/4 in to 1 ft, av 8 in

D 81-41 [#8, 78]
Volcanic (dike) Rhyolite/Dacite?, aphanitic groundmass, 10 to 20% phenocrysts of qtz + plag, mostly qtz, clear + fractured crystals to 3/4 inch, most of outcrop is sl to mod wthd with very closely spaced fractures weathered surface is rusty orange
fracturing random
Sample D-81-41
30 ft exposed, argillite above orientation?

south wide
D-81-42 [#8,29]
Metagraywacke, slaty
cleavage parallel to
bedding, medium to dark gray
alternating beds of sand and
shale sizes from ~2M to
6 inches, fresh to yellow hard,
wthd surfaces black + limonite stained

Joints.
287/36 to 40 S (bedding)
planar + smooth foliation
spacing 1 to 5 in
Block across river failed
along this surface
approx 10 x 30 ft

28/80 E
irregular, rough,
2 to 6 inches

327/50-55 NE
irregular, rough,
Spacing 3/4 to 1 ft

50/55 NW
irregular, rough, 2 to 6 in

Sample D-81-42

One 6 in bed appears to grade
from a fine sand to interlayered
fine sand and shale to shale
this gradation is downward
so beds may be overturned

Changes from this relatively
undeformed rock to completely
folded occur over short
spaces ~100 ft

Joints see book 8

D-81-43 upstream from "42"
[#8,30]
Metagraywacke, consisting of alternating sandy and shaly beds from 2mm to 6in., fresh, hard, well developed cleavage parallel to bedding, some fractures approx 2 in wide along some of these planes, rock in medium to dark gray, black and limonite stn on exposed surfaces.
slaty cleavage
as at previous outcrop "up" is down (beds are overturned) based on graded beds. Not completely certain of this.

D-81-44 [#8,31]
Argillite, dark gray, slaty to phyllitic, [illegible] cleavage, fresh to sl wthd, similar to 42 + 43 in overall appearance, few joints, curved limb of plunging fold exposed, measured orientation of fracture cleavage parallel to axial plane (Book 8)
Qtz veins becoming more numerous, 1/4 to 1 in, folded, unfractured

[#8,32]
D-81-45 - nob sticking out from [illegible]
Metagraywacke, phyllitic grade but poorly developed cleavage, fresh, hard, med to dk gray, remnants of bedding can be seen in the sandy layers, stretched and in some places boudined along foliation, few pyrite vugs, minor qtz stringers

bedding where measurable 304/72SE

Joints

293/55 N
planar to irregular,
rough, spacing 6 in to
3 ft, av 1 ft

65/70 SW foliation
poorly developed cleavage
irregular, rough,

13/88 W
irregular to rough, rough
2 in to 1 ft

at dam axis

D-81-46 bend at entrance to canyon
Metagraywacke consisting
80-8 of interbedded ss and
shale, beds where discernible
are 2 to 6 in, and
argillite, massive, beds
to greater than 5 ft (?)
light to dark grey, fresh,
no strong cleavage,
bedding is "right way" up
both are fresh and hard

Joints

Bedding plane cleavage
* 68/65SE
irregular to planar,
rough to smooth, depends
on folding
more prominent in argillite
spacing av 6 in, some
slide blocks along these planes

~~326 to 340~~
* 353/~~[illegible]~~ 85E
planar, smooth,
spacing 2 in to 1.5 ft
av 6 in

340/43 E
planar to irregular - mostly
to rough
Spacing 2 in to 2 ft (?)

A 20/87 W
planar, smooth
6 in to 2 ft (?), tight

Difficult to determine
fixing because of
snow cover

62/30 NW
planar, smooth
Spacing 2 in to 1 ft

245/60 ?
planar smooth
subparallel to cleavage
av 1 ft

Sample D-81-46
graywacke

Return to Anchorage
4 PM

K7-35 entrance to canyon
looking d/s

K7-36 DC reservoir, scenic

AAI BOOK 8

Bruce
P5701.05
Book #8

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Cheechako Creek 21-24

WCC Samples 16-18

3-26-51

Continuation of [illegible] Book [illegible]. Working on the Waterna site getting joint measurements. See some sedic plagioclase diorite inclusions in the calc plagioclase diorite. Could have two different stages in the formation of the pluton rather magma differentiation.

Joint [illegible] on the left [illegible] near the [illegible] area. [illegible] really [illegible] but [illegible] at W-81-14. Predominantly calc [illegible] diorite, measurements [illegible]

WJ-8

* 1.	[illegible]	283	16° [illegible]
2.	321°	38	79° N — [illegible]
3.	5[illegible]°	50	8[illegible]° SE —
4.	282°	279	16° S —

* Corrected readings marked in red

*

5.	57	60°	76° SE
6.	329	332°	73° NE rough
7.	269	272°	48° N
8.	49	50°	86° NW
9.	319	320°	68° NE
10.	317	320°	66° NE
11.	313	316°	66° SW
12.	42	45°	71° NW
13.	84	87°	44° N
14.	215	218°	16° S
15.	313	316°	63° NW rough
16.	317	320°	74° NE
17.	67	70°	81° S
18.	34	37°	57° NW
19.	47	50°	87° SE
20.	317	320°	75° NE
21.	82	85°	9° N (W)
22.	306	309°	80° NE
23.	315	318°	66° NE
24.	70	73°	37° N
25.	46	49°	80° SE
26.	317	320°	74° NE
27.	43	46°	72° NW
28.	0	2°	30° W
29.	31	34°	77° SE

*Corrected strikes marked in red.

30.	329	327°	78° NE
31.	306	309°	33° NE rough
32.	318	321°	76° NE
33.	32	35°	70° SE
34.	40	43°	63° SE
35.	322	325°	76° NE
36.	47	50°	8[illegible] NW
37.	316	319°	75° NE
38.	36	39°	77° SE
39.	317	320°	84° NE
40.	65	68°	34° NW
41.	10	13°	85° N
42.	1	4°	81° E
43.	55	58°	25° NW
44.	63	66°	22° NW
45.	23	26°	34° W
46.	317	320°	78° NE
47.	40	43°	81° SE rough
48.	21	24°	86° W
49.	51	54°	40° NW
50.	58	61°	72° SE rough
51.	20	270°	22° S
52.	350	353°	75° E
53.	352	355°	53° E
54.	44	47°	78° NW

*

55.	41	44°	74° NW ✓
56.	320	320°	[illegible] ✓
57.	72	75°	28° S ✓
58.	54	57°	41° SE ✓
59.	63	[illegible]	[illegible] ✓
60.	342	345°	[illegible] ✓
61.	320	323°	81° NE ✓
62.	69	72°	42° S ✓
63.	320	323°	82° NE ✓
64.	53	56°	75° NW ✓
65.	79	[illegible]	62° N ✓
66.	34	37°	77° NW ✓ curved
67.	62	65°	28° [illegible] ✓
68.	317	[illegible]	74° N ✓
69.	46	[illegible]	[illegible] NW ✓
70.	316	319°	79° NE
71.	30	34°	12° SW ✓
72.	35	38°	84° NW ✓
73.	297	300°	5° SW ✓
74.	76	79°	44° S ✓
75.	16	19°	52° E ✓ curved. — ?
76.	41	44°	28° NW ✓
77.	25	28°	20° W ✓
78.	318	321°	78° NE ✓
79.	315	318°	71° NW

80.	34	37°	49° SE ✓
81.	20	23°	64° W ✓
82.	321	324°	79° NE ✓
83.	321	324°	29° SW ✓
84.	49	52°	68° SE ✓
85.	61	64°	76° NW ✓
86.	315	318°	49° NE ✓
87.	42	45°	68° SE ✓
88.	69	72°	17° W ✓
89.	7	10°	78° E ✓
90.	56	[illegible]	79° NW ✓
91.	318	321°	79° NE ✓
92.	302	305°	25° S ✓
93.	296	299°	79° W ✓
94.	13	16°	29° W ✓
95.	353	356°	55° [illegible] ✓
96.	289	292°	23° S ✓
97.	82	85°	81° S ✓
98.	74	77°	80° N ✓
99.	76	79°	85° W ✓
100.	74	77°	83° W ✓

Plotted on the red sheet. TS plotted 5-22-81

[illegible] at. June 29th 1981

A-IV dips steeply; irregular, [illegible]

6" to 1'

* Corrected strike measurements in red.

I 320° dips steeply; planes s. curved, smooth
1" to 4'; aver. [illegible]
65° low angle to north; curved,
smooth to rough; 6" to 3'
aver. 1' to 2'
II 65° steep dip to NW; plane to irregular,
smooth to rough; 6" to 1'
IV 260° shallow to south; s. curved,
smooth; 1" to 2', aver. 5" to [illegible]

3-27-81

It's cloudy & snowing fairly hard this morning, temperature is probably in the upper 20's. Will work in Tsusena Creek for at least part of the day. Stopped snowing at approx 10[illegible] ~ 2" fell

Approximately where the buried channel enters Tsusena Creek, find ice in the chute on the slope. Check for the amount of leakage from this point in the spring/summer.

Photo: 2-6-3
W-81-76 [#7,118]
Small outcrop or float rock of light to medium green andesite with lots of large white diorite xenoliths. Also a pcs of buff green shale in contact with the andesite. Diorite seems to make up ~ 60-70% of rock.

Rock is 12' long x 6' high

W-71-11

Large outcrop on the left bank of a volcanic conglomerate & an andesite. The volcanic conglomerate consists of the white, medium-grained diorite as xenoliths in a light [illegible] andesite (?) of which the [illegible] makes up approximately 60-80% of the volume. The outcrop is moderately to highly weathered & fractured. The rock breaks up along the boundries of the diorite and andesite. At least three shears are exposed here (WDK-11's book).

(a) 329° 32° SW [illegible] of oxidized & [illegible] diorite, [illegible] & [illegible] mostly granular [illegible] with some small [illegible]. Average width is about 6" to 8'.

This shear coincides with the contact

between the [illegible] which is on the [illegible] side. Highly adjacent to this shear [illegible] is covered with vegetation & snow but its orientation is ~ 340°, [illegible]

a to b ~ 6'
b to c ~ 21'

Cobbles up to 25' in the andesite
Sampled, andesite (2 pcs) [illegible] (1 pc)

At the [illegible] outcrop on the right bank [illegible] still [illegible] the volcanic [illegible] ~ 300' (?) [illegible] on left [illegible]
320 [illegible] NE, fracture zone ~ 6" to 15' highly jointed

[*7,119]

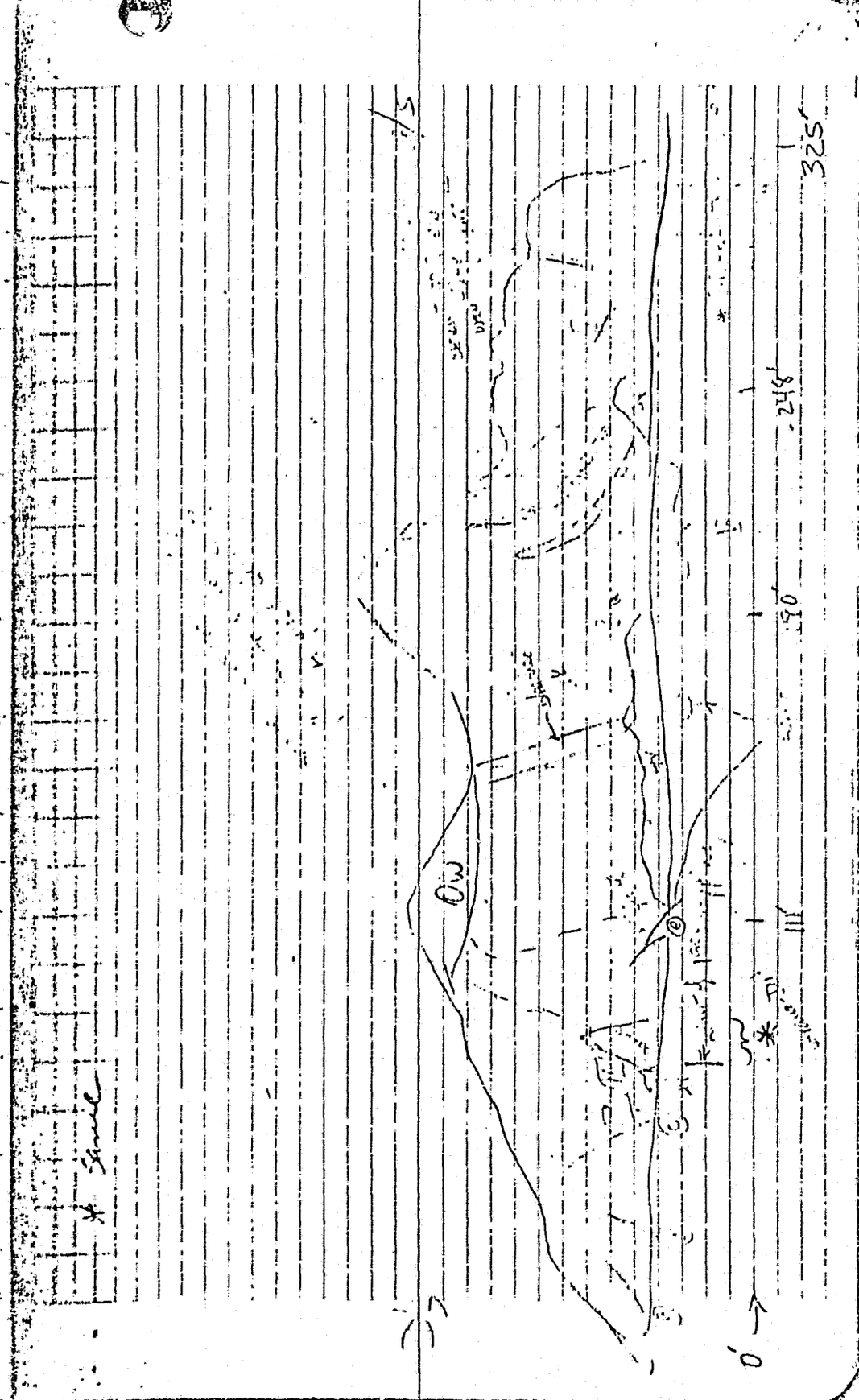
[illegible] hydrothermally altered and sheared outcrop on the right bank, see last years station W-80 — It's approx. 300' long and a max. of ~20' high.

0' d/s end of outcrop

9' (b) 300° 27° SW [illegible] 1-6 wide [illegible] the [illegible] gravel, [illegible]

20' (b) [illegible] vert, highly [illegible] (orange to pale [illegible]) with some clay gouge — pale yellow-white color, [illegible] may be closer to 10° overall 6'

56' (c) 75° 44° N [illegible] hydrothermally [illegible] 6" to 1' wide



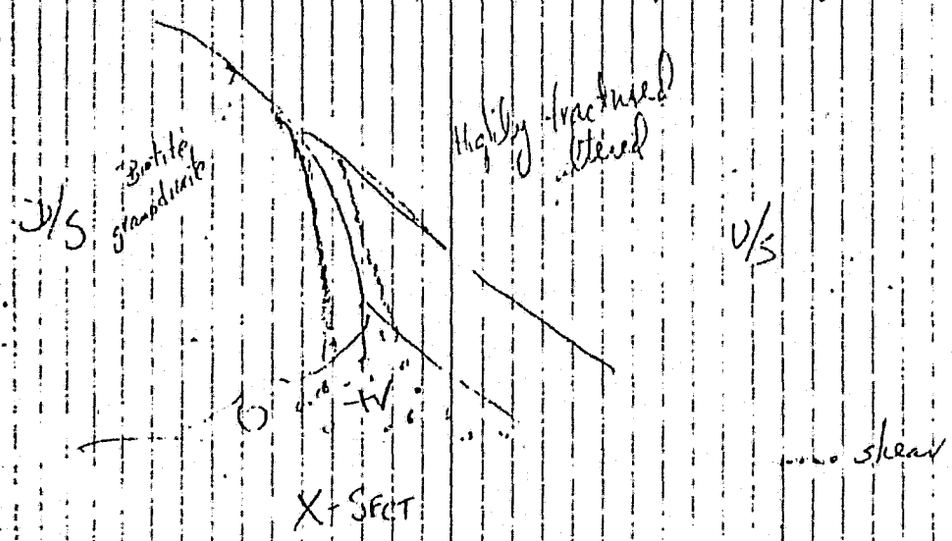
[illegible]	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]
	[illegible]	[illegible]	[illegible]
300°	30° S	curved, [illegible]	
	aves. 2'		
[illegible]	83° NW	plane to [illegible]	
	smooth	1" to 4" [illegible]	
8°	25° E	only [illegible]	
	smooth, [illegible]		
68' (d)	[illegible]	80° SW	[illegible]

[illegible] possibly [illegible]
Fracture zone is [illegible]
At the [illegible] of two [illegible]
rock types(?)

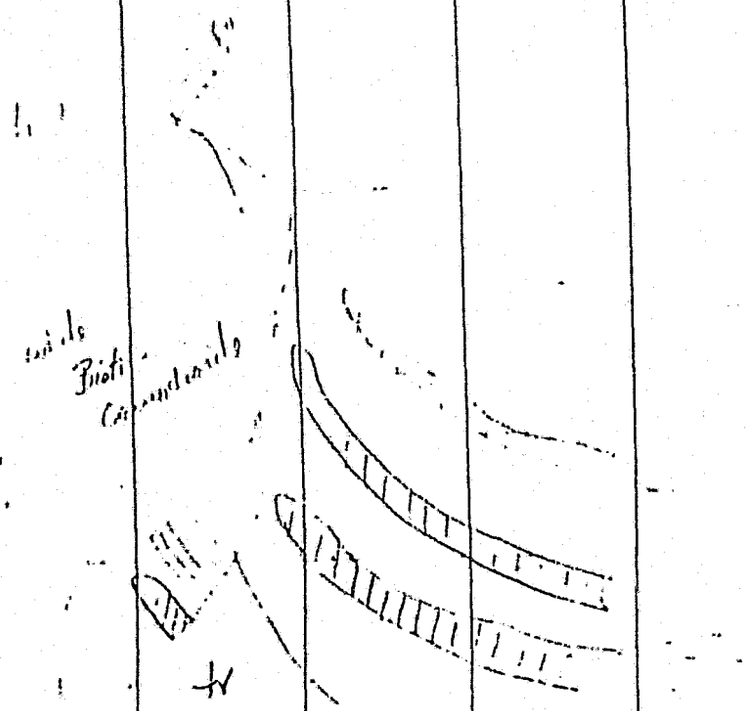
white biotite rich granodiorite [illegible]
U/S side, rock is not as
highly weathered & fractured
pale white to orange hydrothermally
altered rock mostly
plagioclase [illegible]
w/ large quartz eyes
some [illegible] highly
fractured

Photo: Roll #2 D/S → U/S 21-31
32 & 33 vert d/s end

111' (e) Cave with shear zone at 280° 50°N
1" layer of sandy silty [illegible], pale
white gray, highly altered, hydrothermal,
sulfur staining, & small thin veins of
sulfur mineralization, maybe some [illegible]



180' (f) 23° [illegible] W small shear [illegible] zone
of highly fractured & [illegible] 1" to 6"
white [illegible] biotite [illegible]



Zones granular diorite material broken down along the grain boundaries with little thin biotite stringers running through them. Shearing probably caused the alignment of the mica flakes. They are white gray to a red brn color. Bearing & offset of a quartz vein occurred along these. These banding zones are somewhat layered with the white bleached out rock.

The fracturing and shearing zones end abruptly against the biotite granodiorite. See HW's book about thrusting occurring in one of these zones.

Zones strike 280° 53° N.

300'

(1) 293° 43° N crushed rock zone [illegible] wide. Similar in color & material as at (h), also approx. [illegible]

W-87-79

Moderately to highly weathered outcrop of a gray, fine to medium grained granodiorite, lots of quartz, small grains of biotite. Difficult to see the biotite in places. Could be a monzonite or granite.

Joints:

10°	70° E
80°	77° N
370°	65° SW

Collected the [illegible] which [illegible] requested [illegible] to Taste [illegible] for collecting the samples on both days.

WCC [illegible]

Samples (2) [illegible] fine grained volcanics on the [illegible] of Log Creek [illegible] the right abutment [illegible] 2000'. Outcrop is [illegible] [illegible] up. TV?

WCC [illegible]

Sample (1) at [illegible] 10 [illegible] shear, on the [illegible] [illegible] abutment [illegible] gray-green fine grained [illegible] TV?

WCC-4

On the northern side of the [illegible] [illegible] a little [illegible] 3250' elevation [illegible]

[illegible] volcanics [illegible] Outcrop [illegible] highly [illegible]

[illegible] photo #34

[illegible] northeast. TV?

WCC [illegible]

[illegible] a [illegible] This outcrop [illegible] weathered [illegible] sampled (4 pcs) [illegible] fine grained volcanics [illegible] age?

Elevation ~3700'

WCC [illegible]

Apparently in the [illegible], it is a green fine grained rock, visible grains of biotite, [illegible] the volcanics don't seem dense enough for a Permian rock. Sampled (6) at elevation 3000' on a small ridge, [illegible]

the valley is the [illegible] this could be what we have. Have seen mostly limestone in Permian exposures.

WCC-1

The river sampled unweathered outcrop on the left abutment. Green fine grained, dense [illegible] rock of biotite flakes samples(?)

Samples WCC-2 & 3 will be okay for thin sections. Will have to discuss the samples collected at the other sites with JRL before deciding which samples we should send

WCC-4 or 5
WCC-6 or 7

TOD - detailed work is required at the sheared outcrop on Tsusena - WCC

3-28-81

It's a cloudy day, temperature approx. Will do some spot checking in Quarry 'A' and then proceed to Devil Canyon to finish up there.

Photos: 2-6-3, 1-3-8, 1-3-5, 1-3-4

Reviewed Quarry 'A' for K.W. He saw the andesite with xenoliths of the gray-white, medium grained diorite, rhyodacite(?), and possibly dacite. Explained to him that there is probably no diorite in this area except at depth.

Stopped at the knob to collect samples. Make a few measurements

[#7, 130]

Dave Janson

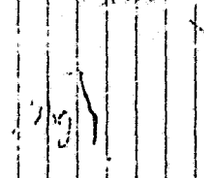
D 81-32 [#7,133]

Large outcrop of the [illegible] gray, fine grained phyllite. Orientation [illegible] from 78° to 85° dipping 73° S. Outcrop is between the mouth of Cherokee creek & the airstrip on the opposite bank. Phyllite is hard, massive, and exhibits prominent bedding plane cleavage. Outcrop is 30' to 40' high and 50 or so long. Small fold, amplitude 4' [illegible] 62° SE, trace 1 to 3'

Thinly bedded

- [illegible] sample of [illegible] of this outcrop & upper 75' upslope, the beds are 58° 42° SE

D-81-33



[illegible] gray, fine grained quartzitic dike [illegible] 8' to 10' wide. Orientation is subparallel to the river, moderately fractured. Weathers [illegible] gray color.

[illegible] the [illegible] of the river, the [illegible] are near vertical on the river right up to the [illegible] or [illegible]. It's a [illegible] gray-rock.

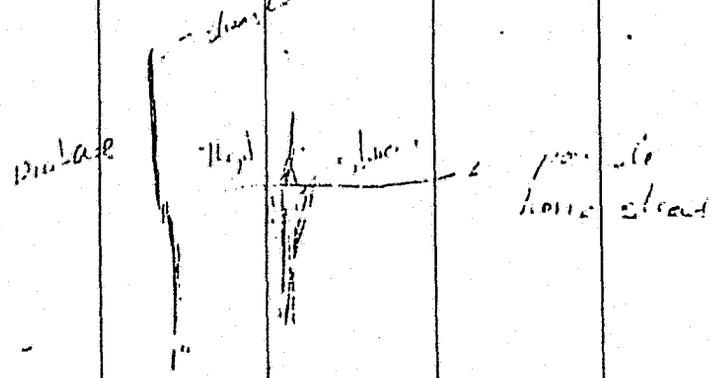
- [illegible] to [illegible] Creek

W-81-34 [#7,136] Diabase Dike

A dark gray fine to v.f. grained dike [illegible] on the [illegible], It's [illegible] the SW [illegible] is [illegible] and is characterized by [illegible]

approximately 25 to 35 wide and is in contact with the white, medium grained biotite granodiorite. It contains large ... of quartz which comprises 30 to 40% quartz. A scale on the opposite side seems to correspond to the trend of the dike.

Shearing occurs at the contact as well as in the Tbgd.



[illegible] dike up [illegible]
Approximate [illegible] of dike [illegible]

Joints:

Dlc:

338°	79° SW
30°	65° NW
82°	36° S
332°	55° NE

Tbgd

85°	39° S

30°	73° SE
42°	75° NW
82°	54° NE

[illegible]

[illegible] turns out to be all sheared, [illegible] up with a gully on the opposite [illegible] oriented 315°. Shearing occurs in the Tbgd [illegible] different shears.

[illegible] surface:

[illegible] 75° W [illegible]

[illegible] 31° SW, [illegible]

[illegible]

[illegible] surface

[illegible] 76° W

[illegible]

[illegible]

[illegible]

[illegible]

[illegible]

40° [illegible] NW

[illegible]
[illegible] outcrop of argillite [illegible]
[illegible] and [illegible] [illegible]
[illegible] data. No bedding plane
cleavage [illegible] open [illegible]
[illegible] weathered. [illegible]
[illegible]
[illegible] gouge.

[illegible] [illegible] [illegible] [illegible] [illegible]
[illegible] the [illegible].

[illegible] [illegible] [illegible]

[illegible] [#7,138]
[illegible] [illegible] [illegible]
[illegible] [illegible] go. Massive [illegible] of
argillite, dark gray, fine grained, [illegible]
[illegible] phyllite, [illegible]
[illegible] [illegible] [illegible] [illegible]
with no bedding plane cleavage.
Argillite is hard, compact, and
slightly weathered and fractured
[illegible] bedding visible, contorted

Some joints are open.

Joints - major
[illegible] 85° N 6" to 2', parallel
smooth to rough, some open
[illegible] 25° N [illegible]
irregular, rough, tight, not
continuous
73° [illegible] irregular, rough
tight 2" to 2'
[illegible] bedding
[illegible] [illegible] [illegible] [illegible]

TOD - contact [illegible] is
irregular in the Cheechako Creek area.
Creek course has followed shears, dikes,
and argillite roof pendants.
Saw some of the hardest & most massive
than usual argillite at station 37, near
the centerline. Wish all the argillite
was this good.
Didn't see any shearing on the right
abutment, opposite the fault, where the saddle
lineament might be expected to intersect.
Bedding is gentler higher up the slope.

[illegible] - 22 [illegible]

It's mostly clear & sunny when AM
Wind [illegible] the temperature is -22°.
Did [illegible] to Dev'l Canyon and
made [illegible] miles d/s of the mouth
of the canyon for a few hours.
Flying check position of the dikes.

Photos: 1-1-1

1-81-10 [#7,141]
Large outcrop of the chalcopyrite
in [illegible] fine grained [illegible] and
pyrite. Chalcopyrite [illegible],
and has slight to moderately weathering
difficult to determine the [illegible]

20° 79° W [illegible] or
[illegible] 57° 55

[illegible] are all the [illegible] in the mines

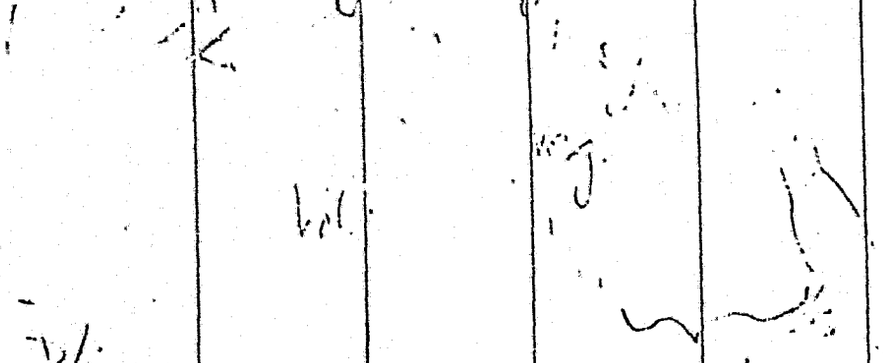
[illegible] d/s [illegible]
57° [illegible]
(Dip is [illegible] the [illegible] of change)
Hold [illegible]
[illegible] [#7,143]
[illegible] fine grained
sandy argillite or graywacke. Sand
particles are generally [illegible]. Sequence
moderately [illegible] [illegible]
[illegible] the [illegible]
& [illegible] [illegible]
[illegible] the [illegible] Dikes
is approx 70' [illegible] [illegible] the
rock is [illegible] [illegible]
moderately [illegible]

Photos:
[illegible] 85 W parallel to [illegible]
[illegible] perpendicular [illegible]
[illegible] 18° [illegible]
[illegible]; [illegible]
parallel [illegible]
[illegible]

276 67°N plane, smooth
[illegible]
[illegible] 67°N plane, smooth
1 to 5
Sampled

D-81-40 [illegible] book [#7,144]

D-81-41 [#7,145]
Small outcrop [illegible] level
of volcanics. [illegible]
20' high by 40' [illegible]
overlain by [illegible]



D/S

the volcanics have a very fine
grained, medium gray groundmass
with [illegible] phenocrysts of clear

[illegible]
[illegible] comprise an [illegible]
of [illegible]
[illegible]. Outcrop is
highly [illegible]
[illegible] 10 [illegible] samples [illegible]
[illegible] any [illegible]
[illegible]. Some phenocrysts of [illegible]
are present.

[illegible]
D-81-42 [#7,146]
Outcrop of [illegible]
[illegible] layer
[illegible]
[illegible] gray [illegible]
[illegible]
Bedding
287° [illegible] plane
smooth, 1" to 5" on the
bedding plane cleavage.
With a [illegible]
[illegible]
[illegible]

D-81-43 [#7,148]

A large outcrop of the [illegible] argillite with prominent bedding plane cleavage. Good laminated bedding [illegible] outcrop. The argillite is phyllitic in places. Outcrop is [illegible] long & [illegible] high.

Bedding

major 60° 77° [illegible], plane to [illegible] smooth [illegible]
60° to 75° 2" to 1'

No prominent bedding [illegible] rough
85° [illegible]
75°

The outcrop with possible shearing associated with it, 1" to 2" of small rock fragments.

Joints:

major 35° 83° SW plane, smooth
1" to 6"

19° 17° W irregular, rough
2" to 6"; S & D is variable

345° 35° NE irregular, smooth

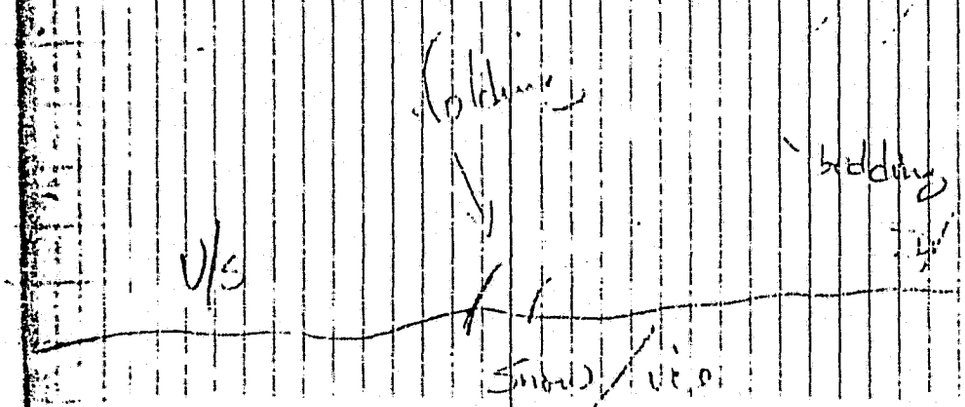
to rough 3" to 1'

150' upstream bedding is
24° 23° SE

Has a prominent notch in the outcrop. Only see a bedding plane shear with some gouge [illegible] ½" bedding plane cleavage closely spaced. Like at [illegible] outcrop only has gouge.

D-81-44 [#7,149]

The charcoal gray fine grained phyllite has been folded. Don't see the thinly laminated beds, contains massive quartz & stringers.



[illegible] bedding, [illegible]

[illegible] parallel to axial plane
[illegible] 61° SW
Plunge
34° SE

[illegible] 45 [#7, 149]
Good [illegible] the argillite & phyllite that [illegible] the river. The rock [illegible] [illegible], blocky [illegible] [illegible] weathered. Not [illegible] [illegible] might be [illegible] more competent, [illegible] [illegible] out here. [illegible] [illegible] bedding plane cleavage. [illegible] quartz stringers.

Stopped at 80-8, argillite & graywacke are interbedded, some graded bedding rock is hard & competent. Graywacke is a light gray, sandy rock with 1/8" to 1/4" detrital grains of quartz & maybe feldspars, which have the appearance of being stretched.
Strike ~ 75° 55° SE

TOD. - Some rotten volcanics is exposed at river level ~ 1.5 miles downstream of the dam site. If any structures are moved downstream, definitely avoid this rock type. I'm concerned about the irregular nature of the plutonic rock beneath the dam site area, would not like to see structures exposing this boundary. Would be nice to be able to do a gravity survey.

Some folding occurs in the argillite in the areas we worked in today