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INFORMAL MEMORANDUM

TO: John Kieling (NMED/HRMB)
FROM: Roy Michelotti (LANL/FU 3)

SUBJECT: GEOLOGIC CORE LOGS FOR BOREHOLES LOCATED AT PRS 16-021(C) & REVISED BOREHOLE LOCATIONS

As you requested in our meeting of 10/9/97, attached are a map showing borehole locations at the TA-16-260 outfall and preliminary geologic logs for three borehole locations, 16-2701, 16-2735/2705 and 16-2736/2708. All three of these boreholes are located in the easternmost geophysical anomaly observed in the outfall area. Note that 16-2736 and 16-2708 are co-located. Drill rod was 'hung up' in 16-2708, so 16-2736 had to be drilled adjacent to that hole. Boreholes 16-2705 and 16-2735 are also co-located, with 16-2705 started last fall and extended to a depth of 15 ft and 16-2736 continued at the same location this summer. These boreholes are relevant to re-siting the final borehole locations that will be completed at PRS 16-021(c). Please note that these logs are preliminary logs of these boreholes based on field observations. Notes on these boreholes are provided below:

- These logs are provisional. All core from these boreholes will be examined and assessed using more precise methods by a geologist who is an expert on extrusive volcanic rocks. The borehole logs will then be revised. The current borehole that the field team is working on, 16-2701, has not yet been logged into draft form. Data shown on the logs is based on quantitative field screening (D-Tech). Interpretations will change as laboratory data is received and incorporated.

- There appears to be a contaminated surge unit that extends to a depth of ~ 7475 ft MSL in all three boreholes, although poor recovery on borehole 16-2735 makes interpretation difficult in this borehole. It is FU 3's current hypothesis that the geophysical anomaly noted in this area may be related to this surge unit and that this surge unit represent a 'fast pathway' for contaminant migration. Note that borehole 2706 (log not provided) does not contain this surge bed interval.

- Contamination appears to be higher in the central (16-2735) and southern (16-2736) boreholes on this traverse. During our presentation last week, we had suggested that the northern borehole (16-2701) was uncontaminated. Further drilling and D-Tech analyses last weekend revealed low-ppm-level HE at depths of 28.5-29.5, 58.0-59.0, and 69.25-69.75 ft. This observation supports a conceptual model in which the downgradient subsurface direction is to the southeast.

- Although there appears to be a correlation between mapped 'fast pathways' such as surge beds and fractures with HE contamination in many cases, low level contamination is also seen in welded tuff in zones where no obvious structural controls are observed.

As discussed in the meeting of 10/9/97, FU 3 would like to place 2 upcoming boreholes: 1) in the eastern geophysical anomaly downgradient from the highly contaminated area (location 1 on the map); 2) outside that geophysical anomaly downgradient from the highly contaminated area (location 2 on the map). These holes will help confirm that the geophysical anomalies are correlated with surge units and will provide information on the

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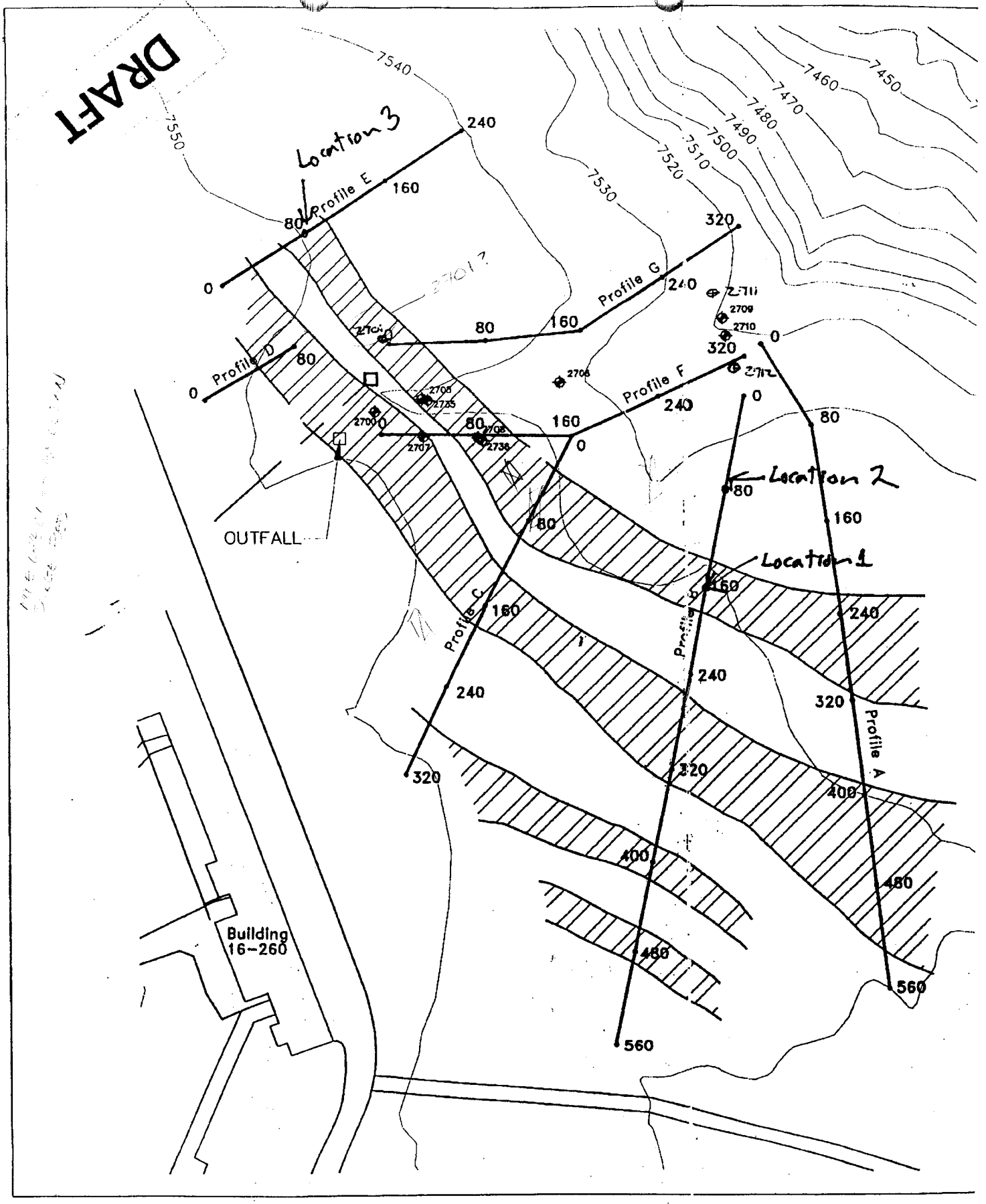
extent of contamination in the surge unit. Our current thinking is that if the borehole at location 2 supports the hypothesis of a continuous surge sequence and is clean, then fracture flow would be the dominant contaminant pathway to the springs. We would then site another borehole in the anomaly closer to the highly contaminated region to better bound contamination in the surge bed.

In the meeting of 10/9/97, FU 3 indicated that a contingent bounding borehole on the north side would not be drilled, because at that time borehole 16-2701 appeared to be clean. Because we have found low levels of HE in that borehole, we now propose to drill an additional borehole in the eastern geophysical anomaly on the north side of the highly contaminated region (location 3 on the map).

Please examine these logs and determine whether you agree that these are reasonable locations for upcoming boreholes. We will be moving the drill rig to location 1 this weekend. These locations are placed along geophysical measurement traverses to avoid dependence upon estimates of anomalous areas between the traverses. We would be glad to discuss this information with you either by phone (Roy Michelotti at 665-7444 or Donald Hickmott at 667-8753) or in association with the bioremediation presentation that is scheduled for tomorrow.

cc. Dave McInroy
FU 3 QA file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Location 3
Location 2
Location 1
Profile A
Profile B
Profile C
Profile D
Profile E
Profile F
Profile G
OUTFALL
Building 16-260
7540
7550
7530
7520
7510
7500
7490
7480
7470
7460
7450
2700
2701
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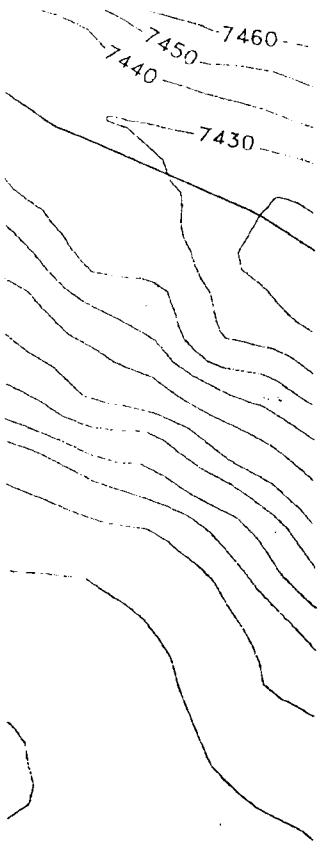
2725
2738



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SCALE: 1" = 100'

LEGEND

- Resistivity Profile
- 80 — Distance (feet) Along Profile
- Grid Marker (Wooden Stake)
- Low Resistivity Zone
- Drainage
- Utilities - Sewer
- Roads
- Approximate Location of Outfall Pipe PRS 16-021(c)
- BORE HOLE

ORIGINAL DWG. "b260tbrd" FROM MARTIN MIELE

TA-16
BLDG 260
BORE HOLE AND OUTFALL LOCATIONS
02/28/97

REVISED 09/05/97 TO SHOW ADDITIONAL BOREHOLES

Eastern Geophysical anomaly - South

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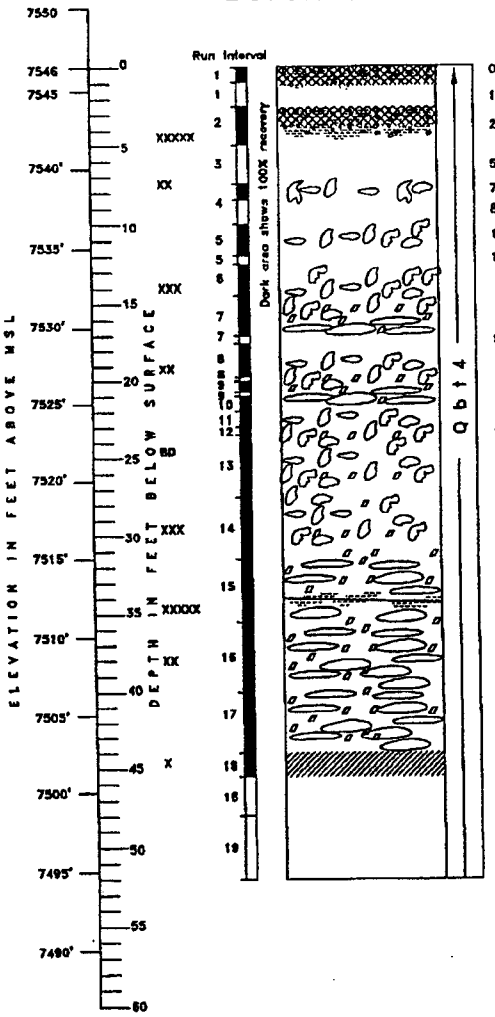
Borehole 16-2708 CO-LOCATED w/ 2786



0-1'	Saturated w/ drill water, predominantly clay, minor organics, sand& dacite gravels, 10YR 4/3(m)
1'-2.5'	No recovery
2.5'-4	Predominantly clay, minor organics, sand& dacite gravels, 7.5YR 6/4 light brown
5'-7.5'	No recovery
7.5'-8.5'	Heavily weathered some lithics, phenocrysts, slightly moist 7.5YR 7/6 reddish brown
8.5'-10'	No recovery
10-12'	Heavily weathered some lithics, phenocrysts, slightly moist 7.5YR 7/6 reddish brown
12-12.5'	No recovery
17'-17.5'	No recovery
12.5-31.5'	Weathered, med. welded, <5% lithics, 20% phenocrysts, 20% pumice ~2cm w/ decreasing pumice at 17.5', 5Y5 7/2 pinkish gray
31.5'-45.5'	Welded, w/ 5% lithics, 10-15% phenocrysts, 10-15% devitrified pumice, 2.5YR 7/2 pinkish gray. fracture at 34.5' w/ clayt development.
44.5'-45.5'	Surge bed material, sandy texture, 20% silts & clay, fine pumice, delinicted bedding layers
45..5'-52'	No recovery
52'	TD

	ROX	D-tech results	
BD = below detection	3x = 2-3 ppm		1+ = 5-6 ppm
1X = 0-1 ppm	4x = 3-4 ppm		2+ = .6 ppm
2X = 1-2 ppm	5x = 4-5 ppm		

PRS 16-021(c)
FU # 3
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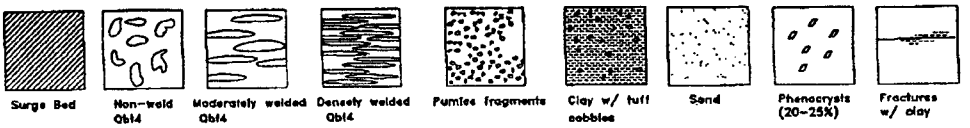

FIGURE. _____ BOREHOLE 16-2708 CORELOG

Eastern Geophysical Anomaly - South

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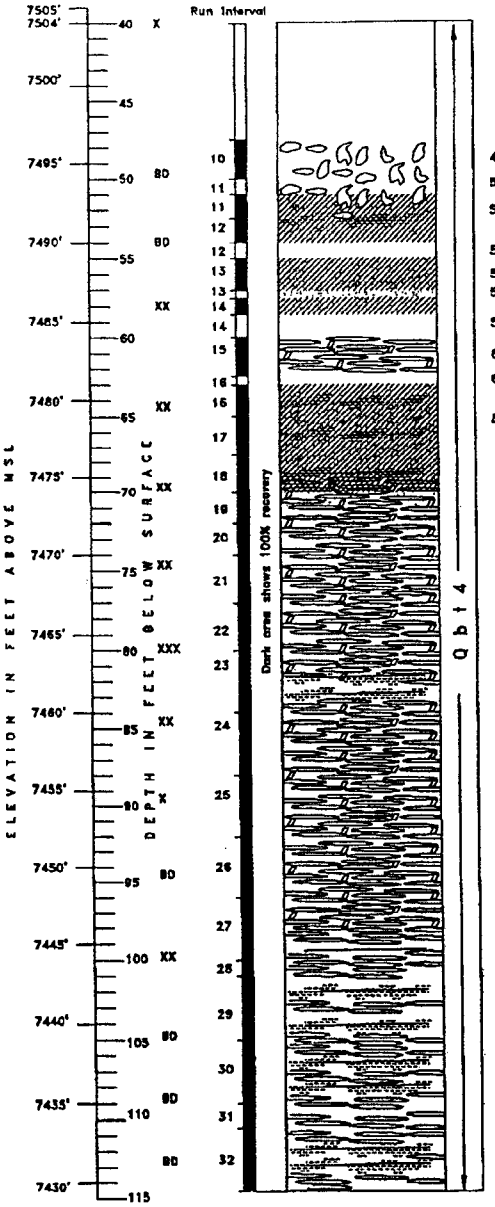
Borehole 16-2736



47.5-50'	Semi welded , 5-10% pumice , 5% phenocrysts, < 5% lithics, some alteration, slightly moist, 10YR 7/1 light gray
50-51'	No recovery
51-54'	Surge bed material & sandy , distinct bedding clay development, 10YR 6/3 light brown color change at 52.5-54' 10YR 7/2 light gray
54-55'	No recovery
55-60'	Surge bed material & sandy , distinct bedding clay development, 10YR 7/2light brown
57-57.5'	No recovery
58.5-60'	No recovery
60-62.5'	Densely welded, 15% phenocrysts, no pumice , no lithics, 5YR 5/1 gray
62.5-63'	No recovery
65-80'	Surge bed material, excellent clay bedding, apparent weathering, 10YR 8/3 pale brown
67.5-114.5'	Mod. to densely welded, 15% phenocrysts,< 5% devitrified pumice, <5% lithics. sanidine is present starting at 72.75'(2.5YR 4/2), color change at 75.1' (7.5YR 4/1 dark gray) fractures w/ clay development occuring at 82', 83.10', 87', 99.8', 102',103',104',105',106', 108',109', 112' &113'.
90'-92'	Color change to 7.5YR 5/1 gray
114.6'	TD

RDX D-tech results

BD = below detection
1X = 0-1ppm
2X = 1-2ppm
3X = 2-3ppm
4X = 3-4ppm
5X = 4-5ppm
1+ = 5=6ppm
2+ = >6ppm

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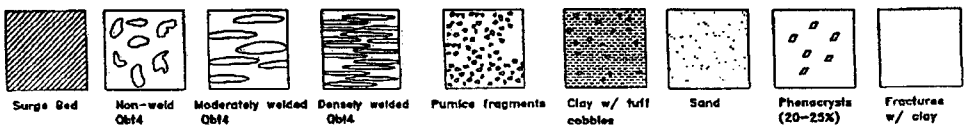

FIGURE. _____ BOREHOLE 16-2736 CORELOG

Eastern Geophysical Anomaly - Drainage

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Borehole 16-2705 CO-LOCATED W/ 2735

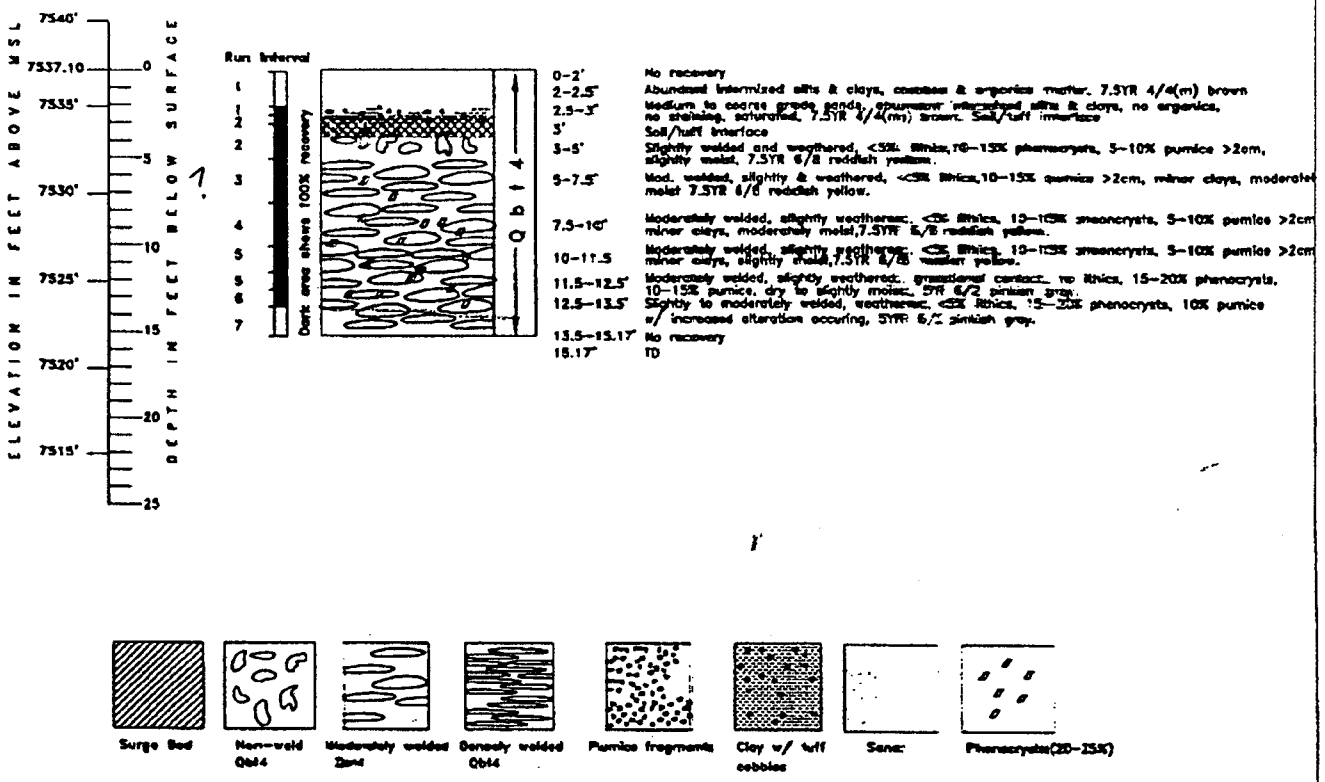

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FIGURE. 4.3.1 BOREHOLE 16-2705 CORELOG

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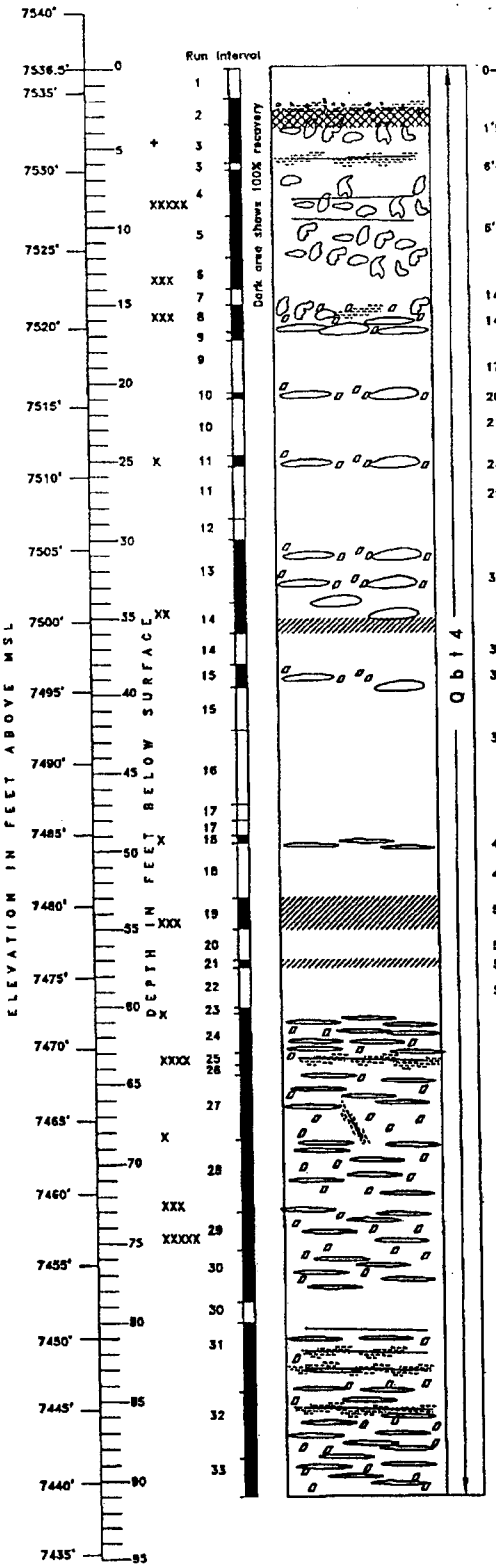
Borehole 16-2735

Eastern Geophysical anomaly - Drainage



0–1'9"	No recovery
1'9"–6'	Soil w/tuff cobbles(dacite) saturated w/water from drilling clay predominant, no organics 7.5YR 5/6 strong brn.soil/tuff interface @3.5' predominantly clay,some dacite gravel,7.5YR 4/1 dark gray
6'–6'6"	No recovery
6'–14'	Slightly welded, w/ fractures @6'& 9'4", 10% pumice fragments, <5% lithics, 10 % phenocrysts, 2.5 YR 4/3 reddish brown, wet from drilling.
14'–14'6"	No recovery
14'6"–17'2"	Weathered, slightly to moderately welded,increase in phenocrysts,20–30%, 5% lithics, 5% pumice, 2.5 YR 4/3 reddish brown, wet from drilling.
17'2"–20'8"	No recovery
20'8"–21'	Minor to no weathering, welded, 20–25% phenocrysts, 5% lithics, 5% pumice, 2.5YR 5/1 reddish gray
21'–24'8"	No recovery
24'8"–25'4"	Minor to no weathering, welded, 20–25% phenocrysts, 5% lithics, 5% pumice, 2.5YR 5/1 reddish gray
25'4"–28'8"	No recovery
30'–36'	Mod. welded, 20–25% phenocrysts,<5% lithics, 5% pumice, 2.5YR 5/1 reddish gray Surge bed 35'–36' sandy, minor clays.
36'–38'	No recovery
38'–39'6"	Slight to mod. welded, 15–20% phenocrysts,<5% lithics, 5% pumice, 10YR 5/2 grayish brown.
39'6"–48'	No recovery
48'–49'6"	Densely welded, 10–15% phenocrysts,<5% lithics, 5% pumice, 10YR 3/2 dark brn.
49'6"–53'	No recovery
53'–55'	Slough 53–53'6". Surge bed 53'6", sandy texture, alteration, pyroclastic. 53'–6"–53'8" 10YR 5/4 yellowish brn, 53'8"–54'2" 2.5YR 6/1 reddish gray, 54'2"–55' 10YR 5/4 yellowish brown
55'–57'	No recovery
57'–57'6"	Surge bed, sandy 10YR 5/4 yellowish brown.
57'6"–60'	No recovery
60'–78'10"	Welded, 20–25% phenocrysts, <5% pumice, <5% lithics, smectite weathering on 5% olivo pyroxene, high angle fracture from 67'–68'4" w/ some clay development, moist from drilling. 60'–63'10YR 5/1 reddish gray, 63'–63'10" 10YR 5/2 weak red, 63'10" –78'10", 10YR 4/1 dark reddish gray.
78'10"–80'5"	No recovery
80'5"–91'	Densely welded, 20–25% phenocrysts, <5% pumice, <5% lithics, smectite development on olivo pyroxene, fractures 80'11'–81'1", 82'3"–82'6",82'6"–84' 10YR 4/1 dark gray, color change @ 88'6" to 2.5YR 4/1 dark reddish gray.
91'	TD

RDX D-tech results

BD = below detection 3X = 2–3ppm 1+ = 5–6ppm
1X = 0–1ppm 4X = 3–4ppm 2+ = >6ppm
2X = 1–2ppm 5X = 4–5ppm

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FIGURE. _____ BOREHOLE 16-2735 CORELOG

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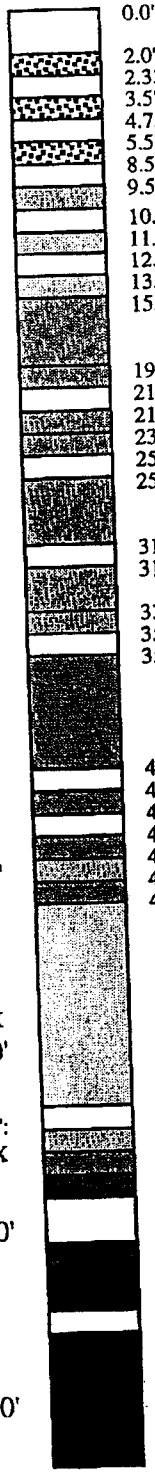
Borehole 16-2701 Eastern Geophysical anomaly -north



0.0'

0.0'-2.0'- no recovery

2.0'-2.33'-dacite cobble, silts and clays
2.33'-3.5'-no recovery
3.5'-4.75'-intermixed silts and clays, dacite and tuff gravels
4.75'-5.5'-no recovery
5.5'-8.5'-intermixed silts and clays, dacite and tuff gravels
8.5'-9.5'-no recovery

10.0'

9.5'-10.5'-heavly weathered Qbt, phenocrysts present, no pumice 7.56 YR 6/6(m)
10.5'-11.5'-no recovery
11.5'-12.75'-heavly weathered Qbt, 15-20% pheno, <5% lithics,10-15% devitrified pumice
12.75'-13.5-no recovery
13.5'-15.5'-heavly weathered Qbt, 15-20% pheno, <5% lithics,10-15% devitrified pumice
15.5'-19.5'-heavly weathered,slightly welded Qbt, 15-20% pheno, <5% lithics,10-15% devitrified pumice, 7.5YR 6/6(d)

20.0'

19.5'-21.0'-slightly welded Qbt, <5% lithics, 25-30% pheno, <5% pumice 5YR 6/4(d)
21.0'-21.5'- no recovery
21.5'-23.5'-slightly welded Qbt, 5% lithics, 25-30% pheno, <5% pumice 5YR 6/4(d)
23.5'-25.0'-slightly welded Qbt, 5% lithics, 25-30% pheno, 5-10% pumice 5YR 6/4(d)
25.0'-25.5'- no recovery

28.5'-29.5': 3.6ppm RDX

25.5'-31.0 -slightly welded Qbt, <5% lithics, 20-25% pheno, <5% pumice 5YR 6/2(d)

30.0'

31.0'-31.5'-no recovery
31.5'-33.5'-slightly welded Qbt, <5% lithics, 20-25% pheno, <5% pumice 5YR 6/2(d)
33.5'-35.0'-slightly welded Qbt, <5% lithics, 25-30% pheno, <5% pumice 5YR 6/2(d)
35.0'-35.5'-no recovery
35.5'-43.0'-slightly to mod. welded Qbt, <5% lithics, 25-30% pheno, <5% pumice 5YR 6/2(d)

40.0'

43.0'-43.5'-no recovery
43.5'-45.0'-slightly to mod. welded Qbt, <5% lithics, 25-30% pheno, <5% pumice 5YR 6/1(d)
45.0'-45.5'-no recovery
45.5'-46.5'-slightly to mod. welded Qbt, <5% lithics,25-30% pheno, <5% pumice 10YR 6/2(d)
46.5'-46.75'-clay present, slightly moist, 10YR 6/2(m)

50.0'

46.75'-47.5'-slightly to mod. welded Qbt,<5% lithics,25-30% pheno,<5% pumice 10YR 6/2(d)
47.5'-62.0'-surge bed with clay bedding, slightly moist, 10YR 6/2(m)

51.0'-51.25'-darker, grainy band, 10YR 5/4(m)

58.0'-59.0': 2.8ppm RDX

56.5-57.5'-grainy texture, 7.5YR 7/1(m)

60.0'

60.0'-62.0'-7.5YR 7/1(d)
62.0'-62.5'-no recovery
62.5'-65.0'-soft Qbt,possible semectite alteration (5YR 8/4(d)),64.2'-clay layer

69.25'-69.75': 2.4ppm RDX

65.0'-66.5'-slightly to moderately welded Qbt,no lithics,25-30% pheno w/ semetite alteration on clino.,<5% pumice, dry 7.5YR 6/1(d)
66.5'-67.0'-moderately welded Qbt,no lithics,25-30% pheno w/ semetite alteration on clino., sanidine present,no pumice, dry,5YR 4/1(d)

70.0'

67.0'-69.25'-no recovery
69.25'-69.5'-moderately welded Qbt,no lithics,25-30% pheno w/ semetite alteration on clino.,no pumice,dry,5YR 5/1(d)
69.5-69.75'-no recovery
96.75'-72.0'-densly welded Qbt,no lithics,20-25% pheno. w/ semectite alteration on clino.,no pumice,sanadine present, 5YR 4/1(m)
72.0'-81.0'-densly welded Qbt,no lithics,30-35% pheno. in clusters w/ semectite alteration on clino.,no pumice,sanadine present,5YR 4/1(m)

80.0'