WAG 9

APPENDIX I

ANL-W WELL LOGS

for OPERABLE UNIT 9-04: COMPREHENSIVE RI/FS FINAL WORK PLAN

Prepared By
Argonne National Laboratory-West

Project Location IWP

Consultant Northern Engineering and Testing, Inc.

Total Depth 54.5

LOG OF BOREHOLE ANL-M1

Drilling Notes

Lithology

Materials Description

0

Pilot hole 3 3/4" diameter at depth 3.0' BGS. Done w/ auger hole – pilot hole @ 1350 hours.

Core 1 – bottom 7.7' BGS

Core 2 – bottom 9.25' BGS core recovery 2.10'

10

Core 3 – bottom 12.6' BGS core recovery 3.3'

Core 4 – bottom 17.6' BGS core recovery 5.0' (full)

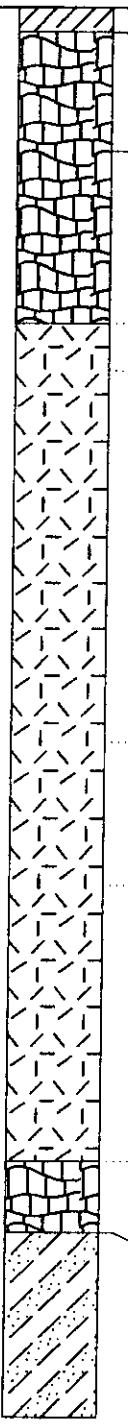
20

Core 5 – bottom 22.5' BGS core recovery 4.85'

Core 6 – bottom 24.5' BGS core recovery 0.8'

Core 7, Core 8, and Core 9 were jammed w/ recovery of 1.5' of core. Total from 3.5' of hole

30



Light to medium brown or tan SILT, Clayey; (LOESS) Soil and Subsoil, well sorted, loose, and dry, does not form ribbons or rollers.

Dark gray to Black BASALT; Weathered and loose fragments, vesicular Basalt w/ trace Olivine and abundant Pyroxene

Light to medium gray BASALT; vesicular and fractured; fine grained crystals of pryoxene; vesicles up to 3/4" diameter; vesicles and fractures are often filled w/ Light tan Clayey SILT, well sorted and well compacted; rock is generally dry although moisture condensed on lexan tube.

BASALT; As above w/ fewer vesicles that appear smaller and w/ less Clayey SILT; decrease in fractures from above.

BASALT; as above, more dense, less vesicles smaller in size.

Light gray to medium gray and occasionally orange BASALT; abundant 1/8" diameter vesicles; cores easily; Silty and very fine grained Sandy in part; Basalt is very fine grained crystalline to cryptocrystalline.

Light gray BASALT; As above, more dense, larger voids, less sediment in voids; very tough coring.

Light gray to Red-orange BASALT; vesicular and fractured (auto-breccia?); very tough to core; voids and vesicles contain Silty sediment that is very moist in part.

Light brown to tan SILT, very fine Sandy; Sedimentary interbed; fragments of Basalt; large voids filled w/ sediment.

Project Location IWP

Consultant Northern Engineering and Testing, Inc.

Total Depth 54.5

LOG OF BOREHOLE ANL-M1

Drilling Notes

Core 10 – bottom 37.15' BGS core recovery 3.9'

Core 11 – bottom 40.0' BGS core recovery 2.5'

Core 12 – recovered 1' core; core barrel blocked

Core 13 – core barrel blocked, no return in core barrel

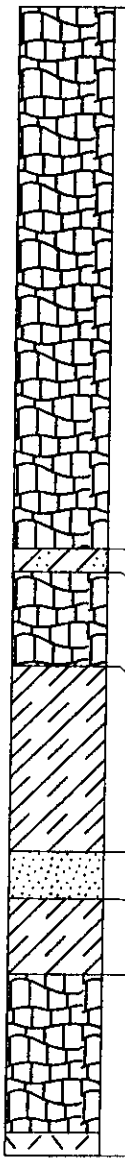
Core 14 – 0.3 ft core recovery 100%

Core 15 (43.1' – 47.6') core return was approx. 0.3'

Begin shelby tube sampling 0955 on 9/1/87 Penetration 4" @ 3000 psi 2" @ 4000 psi 3" @ 5000 psi 11" @ 6000 psi Total 20" ST – – 1; no return except for cuttings on outside of tube; material is dark brown to reddish brown Clayey SILT, moist, forms ribbon Bagged cuttings available; interval sampled was 40' to 50.6 feet Shelby tube bottom was bent out slightly. Probed hole; no water ST – – 2; Penetration depth – 50.6 feet BGS – refusal at 600 psi down pressure; one foot return; bagged sample – part of sample caved from above (sample bag indicates 48 – 49 feet); bagged sample zone (49 – 50.6 feet). Lithology 48' – 49'; Medium SAND; red to brown, Cinders common, Basalt fragments common, dry. 49' – 50.6'; Light gray to buff SILT, Clayey; occasional weathed weathered zones, moist – no free water evident – probably zone containing water. ST – 2 refusal at 50.6' – probable contact w/ Basalt bedrock at 50.6'

Core 17 – sample interval = 50 – 55 feet; recovery 1.5 feet

Lithology



Materials Description

Light to medium gray BASALT; very fine crystalline to cryptocrystalline; vesicles 1/8" to 1" diameter, some filled w/ Light green Olivine; also some Medium to dark brown crstalline void filling.

Light brown SILT, Sandy; Sedimentary interbed – no return in core barrel – drilled easily identified on cuttings, Basalt fragments common.

Light to medium gray BASALT; very fine crystalline, competent, vesicles 1/8", drills like Basalt is highly fractured; numerous Brown Sandy SILT interbeds present.

Light brown to tan SILT, Clayey; Sedimentary interbed, cores relatively fast – slightly moist?

Red to brown medium SAND; CINDERS common, Basalt fragments common, dry.

Light to medium gray BASALT; numerous vesicles; highly fractured 52–54 feet; vesicles to 1/4" size; dry.

Project Location IWP

Consultant Northern Engineering and Testing, Inc.

Total Depth 80

LOG OF BOREHOLE ANL-M2

Drilling Notes

Lithology

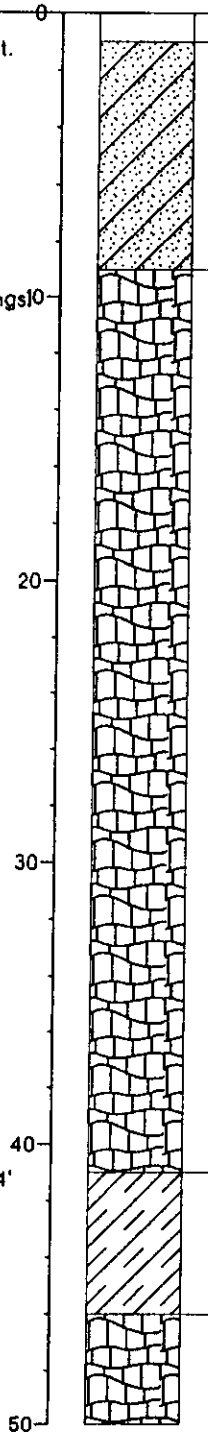
Materials Description

Sampling cuttings from rotary drill every 5 feet.

Zone from 11' to 20' BGS drilled easiest; no sedimentary interbed identified from drill cuttings

No saturation found. Sample w/ Shelby tube 44' - 45'; and 45' - 46'.

Driller reports fractured Basalt from 81' to 83' bottom of reamed hole (sample cuttings from rotary rig).



Light to medium brown SILT, Sandy; Soil; very little water content; rootlets throughout

Light to medium brown SAND, Silty; (alluvium/loess) moist in lower part; well sorted; very few clasts above sand size.

Light to dark gray BASALT; vesicular; abundant secondary porosity as fractures.

Light to medium brown SILT, Clayey; Reddish in part; moist in upper few inches, dry in lower part.

Light to dark gray BASALT; Same as above; dry.

Project Location IWP

Consultant Northern Engineering and Testing, Inc.

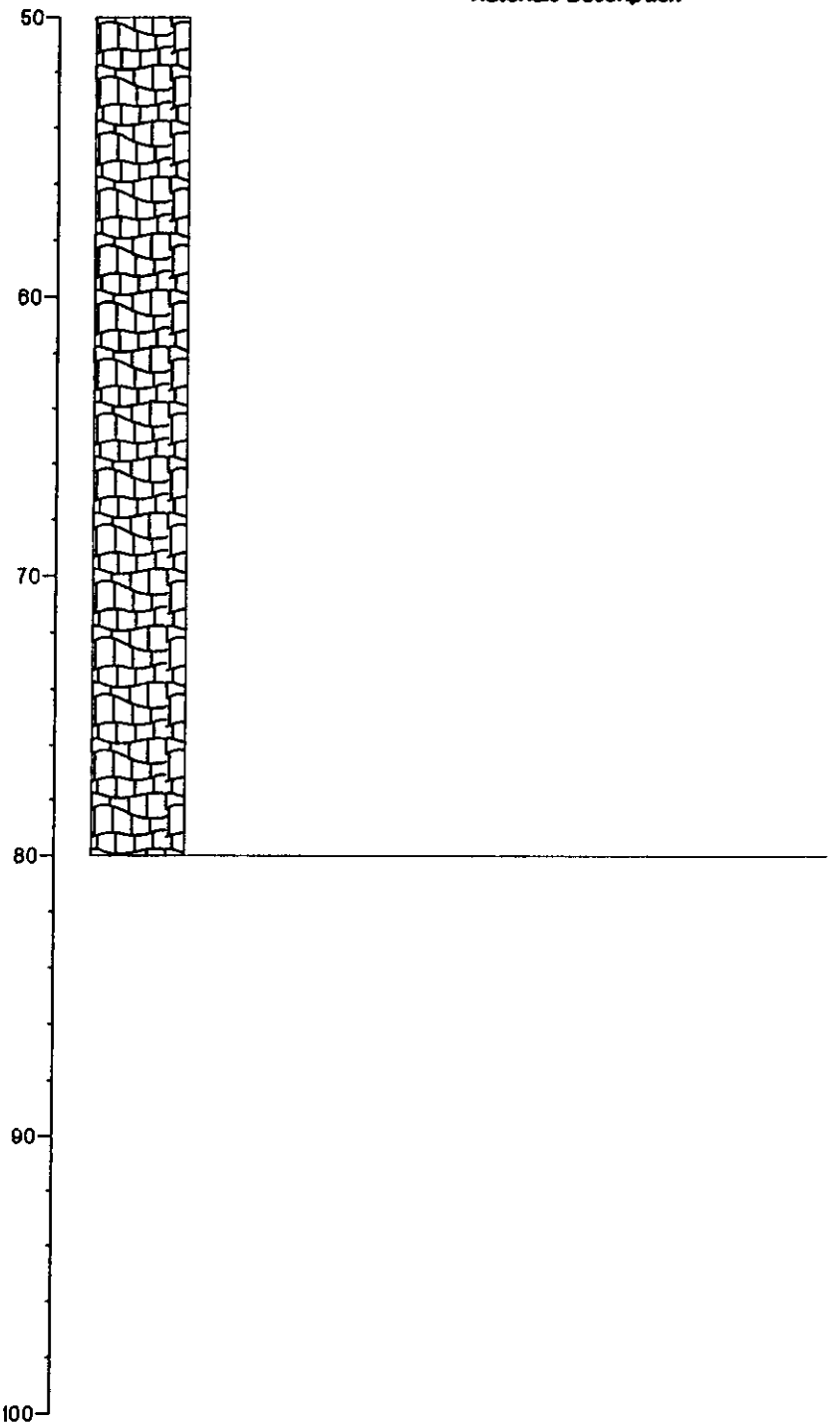
Total Depth 80

LOG OF BOREHOLE ANL-M2

Drilling Notes

Lithology

Materials Description



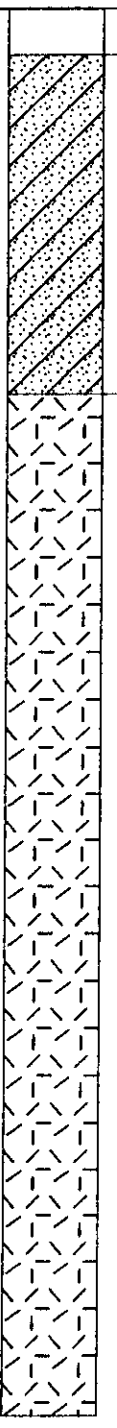
Project Location IWP

Consultant Northern Engineering and Testing, Inc.

Total Depth 60

LOG OF BOREHOLE ANL-M3

Drilling Notes	Lithology	Materials Description
	0	Light to medium brown SAND, Silty; Soil; slightly moist - no ribbons; rootlets throughout
		Light to medium brown and tan SAND, Silty; (alluvium/loess) moist in lower part - does not form ribbons; fairly well sorted; dry in lower part
slow drilling; bag sample of cuttings at 10', 20', 30'.		Light to medium gray BASALT; finely crystalline; dry
	10	
	20	
	30	



Project Location IWP

Consultant Northern Engineering and Testing, Inc.

Total Depth 60

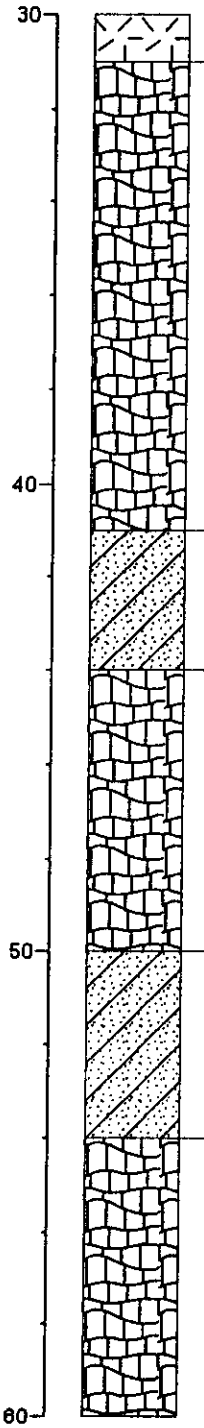
LOG OF BOREHOLE ANL-M3

Drilling Notes

very fast drilling, 5 feet in 2 minutes

On 9-16-87 Probed hole - no water.

Lithology



Materials Description

Medium to dark gray BASALT; highly fractured or large void

Light to medium brown and tan SAND, Silty; occasional oragne and dark brown color; Clayey in part; very moist in upper part; no standing water after 1/2 hour.

Light to medium gray BASALT; Same as above; w/ probable sedimentary infilling of fractures

SAND, Silty w/ Clay; Same as above; very wet at 52'.

Light to medium gray BASALT; Same as above; dry in lower part.

Project Location IWP

Consultant Northern Engineering and Testing, Inc.

Total Depth 68

LOG OF BOREHOLE ANL-M4

Drilling Notes	Depth	Lithology	Materials Description
	0		Light to medium brown SAND, Silty w/ abundant CLAY; Soil; dry does not form ribbons or rollers; rootlets throughout.
			Light to medium brown and tan SAND, Silty; (alluvium/loess) dry except for slight moisture in lower part; moderate sorting; some Basalt fragments in lower part.
			Light to medium gray BASALT; vesicular and fractured (apparently) w/ sedimentary infilled zones; large voids apparent.
	10		
			Light to medium brown and tan SAND, Silty; Loess Slightly moist
			Light to medium gray BASALT; As above; occasional fractures, voids, and fissures.
			Numerous voids; water at 20', 5 - 10 gpm initially.
	20		
NO RETURNS			NO RETURNS - lost circulation
NO RETURNS	30	CAVI	Crevise or sedimentary interbed (?) Silty SAND or very soft spot;
			Light to medium gray BASALT;
	40		
NO RETURNS		CAVI	Possibly a sedimentary interbed or large voids and fractures;
NO RETURNS			Light to medium gray BASALT;
	50		

Project Location IWP

Consultant Northern Engineering and Testing, Inc.

Total Depth 68

LOG OF BOREHOLE ANL-M4

Drilling Notes

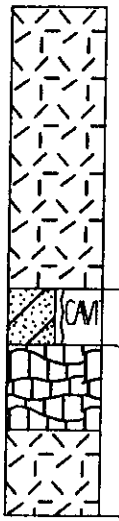
NO RETURNS

NO RETURNS

NO RETURNS

Circulation required, sample cuttings At 1450 hours - flow in well from void at approx. 22' on NW side of bore; SWL = 30' - flow is approx. 10 gpm and disappears in lower part of bore. SWL is very difficult to measure due to cascading water.

Lithology



Materials Description

Sedimentary interbed (?) or very large void or fracture; Shelby tube at 61.0' yielded only broken Basalt (sample).

Light to medium gray BASALT; moderately soft and semi- easy pentration

hard and more difficult pentration

Project Location IWP

Consultant Northern Engineering and Testing, Inc.

Total Depth 63.3

LOG OF BOREHOLE ANL-M5

Drilling Notes	Depth	Lithology	Materials Description
drills evenly	0		Light to medium brown and tan Silty SAND to Clayey SILT; Soil, very loose and non compact; dry; no ribbons or rollers
			Light to medium gray and occasionally dark gray BASALT; sediment infilled in upper part; vesicular and large voids evident; no sedimentary interbeds apparent; No appreciable water
	10		BASALT; As above; very large vesicules or voids.
	20		
easy drilling			Soft BASALT fractured; lost returns until 35'
	30		
even drilling			BASALT; As above; somewhat smaller voids and/or vesicules; dry.
	40		
			BASALT; As above; small fractures, w/ minor water seepage.
			BASALT; As above; small voids and vesicules; slight water seepage.
			BASALT; As above; fractures, w/ minor seepage.
	50		

Project Location IWP

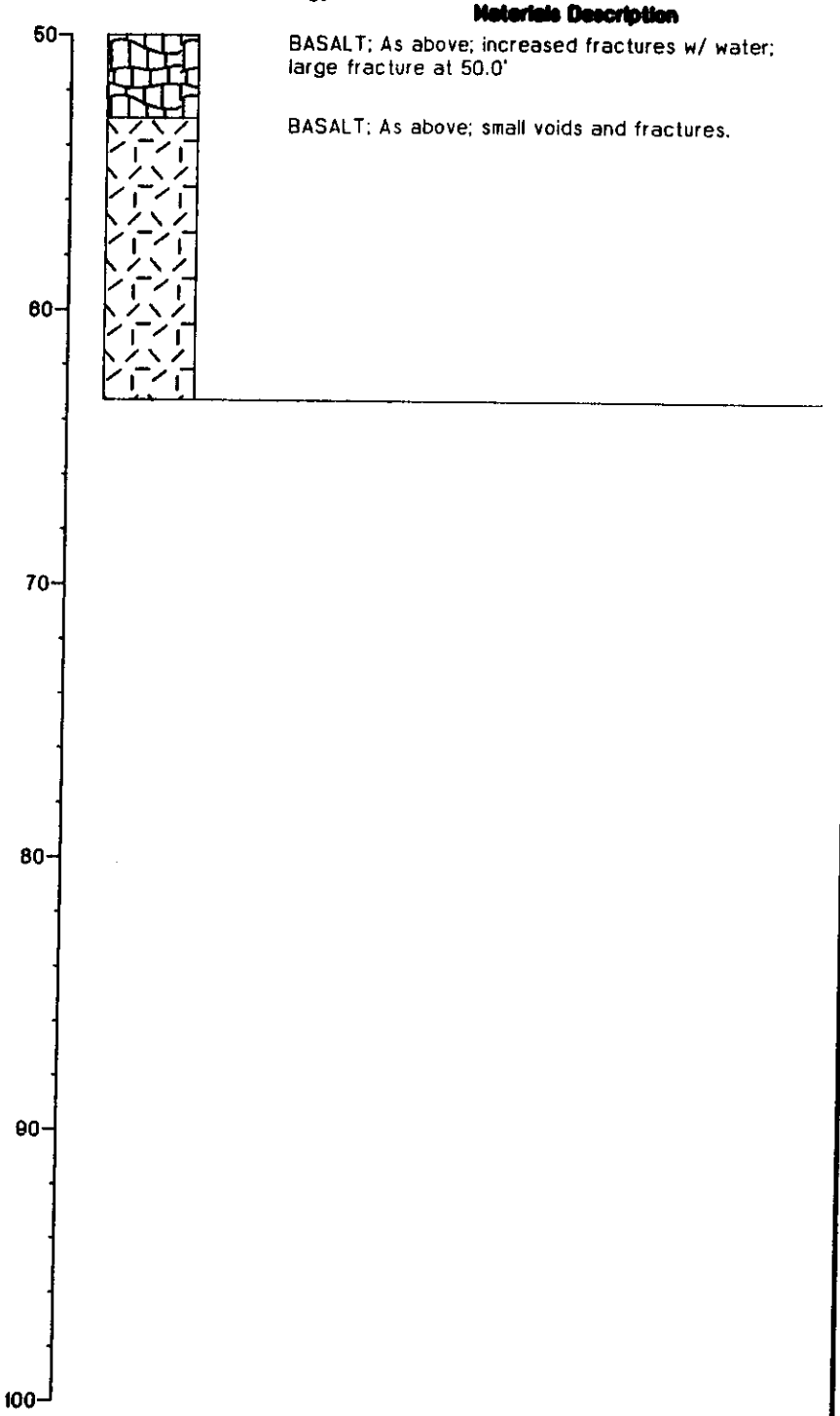
Consultant Northern Engineering and Testing, Inc.

Total Depth 63.3

LOG OF BOREHOLE ANL-M5

Drilling Notes

Lithology



Materials Description

BASALT; As above; increased fractures w/ water; large fracture at 50.0'

BASALT; As above; small voids and fractures.

Project Location IWP

Consultant Northern Engineering and Testing, Inc.

Total Depth 423

LOG OF BOREHOLE ANL-M6

Drilling Notes

cuttings collected for each 5' of penetration

lost drill fluid circulation at 18'.

regained circulation at 25'

very soft drilling; lost circulation.

even drilling; circulation regained.

11/09/87 Extended hole to 67' to ensure hole extends through water producing zone; reamed hole to 8" diameter from 0-67'; grouted well from 61ft - 67ft w/ 2 cubic yards of cement and from 20ft - 61 ft w/ an additional 2 cubic yds.

11/10/87 Drilled out cement grout with 6" bit; bit and stabilizer = 6.1'; penetration rate of 1 - 2 feet per minute; concrete still quite green.

Concrete is very soft, but may suffice as a mud pack; penetration rate < 1 foot per minute. It appears the grout has effectively sealed off the water producing zone.

harder drilling

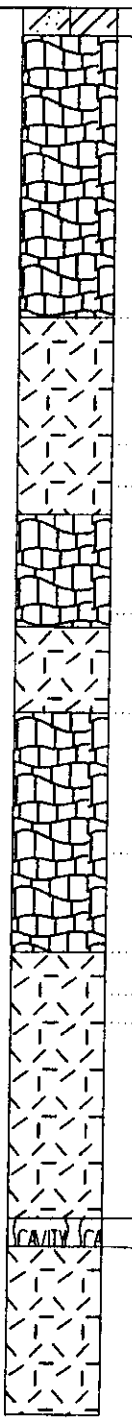
hard bond drilling, poor recovery, penetration rate approx. 1/2 foot per minute.

tripped out for new bit

Crevice or void - drill rod fell through.

No returns - circulation and cuttings probably lost to above crevice; penetration rate of 1 foot per minute.

Lithology



Materials Description

Light to medium brown SAND, Silty or Clayey SILT; Soil; very loose and dusty; no moisture.

Light to medium gray BASALT; occasionally dark gray in color; sediment infilled in upper part fractured or very vesicular and porous.

BASALT - as above; firm and hard w/ few fractures.

BASALT - as above; large voids or vesicules

BASALT - as above; fractured or very soft drilling; seepage of water at 43'.

BASALT - as above; solid or massive; large fracture w/ increased water at 48.5'.

BASALT - as above; fractured or highly vesicular; some water seepage; very large void or fracture at 54'.

BASALT - as above; highly fractured.

BASALT - harder drilling; dense; apparently dry.

BASALT - dense.

Poor returns; dry medium gray powder; occasional chips of hard, dense Basalt; no vesicles.

Crevice or void.

Only recovery is a light gray, dry powder; crevice likely.

BASALT - as above; appears slightly moist.

Project Location IWP

Consultant Northern Engineering and Testing, Inc.

Total Depth 423

LOG OF BOREHOLE ANL-M6

Drilling Notes

Lithology

Materials Description

100

penetration rate of 1 ft/min

No returns - circulation lost to crevice; penetration rate of 1.0'/min to 1.5'/min; pull down pressure 1000#; dry powder during trip out at connection.

110

120

No returns - lost circulation; penetration rate of 1 ft/min.

130

penetration rate 0.25 ft/min.

penetration rate approximately 3'/min; tripped out to check for water in fractures 16:20; ran trip blank on bit and stabilizer. 140

0.85 foot/minute; driller not using large compressor because of fractures.

approximately 0.7 feet/minute. 150

began reaming at 13:00 to 8" diameter; completed reaming to 155' at 15:30.

No returns; pull down pressure 10,000#; penetration rate of 0.20 feet/minute; 16:00 tripped out and left hole open for USGS to run 160 geophysical logs. 11/12/87 USGS ran gamma and caliper logs in A.M. 13:00 set 6" ID steel casing - 151.4 with 6" drive shoe = 162.0'; emplaced hi-early concrete grout in bottom of hole and drove casing with hammer final 2 feet; 14:00 completed installing casing and tripped back into 170 hole w/ 6" bit.

penetration rate of 0.5 feet/minute

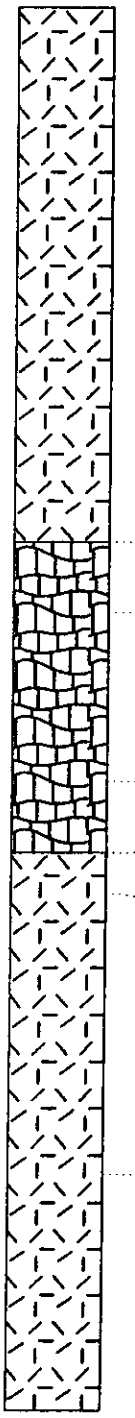
pull down pressure 15,000#.

180

pull down pressure 15,000#.

190

200



BASALT - as above; highly fractured; checked for water; SWL 143.7.

BASALT - fractured; no returns.

BASALT - as above; very hard; dense.

BASALT; hard; dense; dry cuttings; sharp concoidal fracture.

BASALT; hard; dense; few vesicles.

BASALT; hard; concoidal to hackly fracture; few vesicles; dry.

Project Location IWP

Consultant Northern Engineering and Testing, Inc.

Total Depth 423

LOG OF BOREHOLE ANL-M6

Drilling Notes

penetration rate approximately 0.9 ft/min; consistent drilling.

consistent drilling at approxamately 0.8 - 0.9 feet/minute.

harder drilling; penetration rate of approximately 0.5 - 0.7 ft/min.

very hard drilling 0.5 feet/minute.

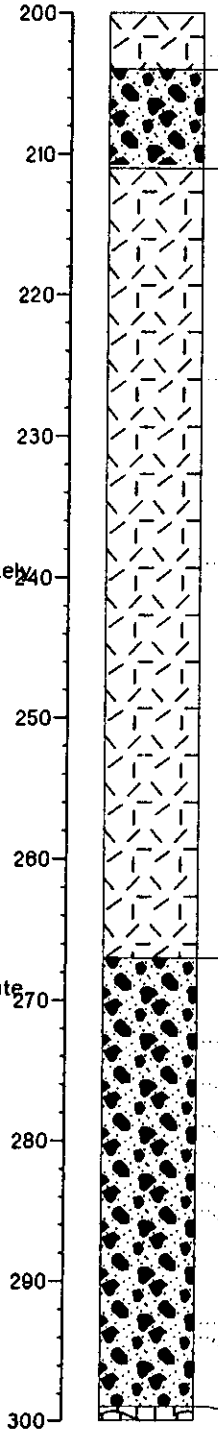
still firm drilling; pull down pressure 5000#; penetration rate approximately 0.65 feet/minute.

using only rig compressor; good returns

softer, but firm drilling.

penetration rate approxiamtely 0.5 -0.6 feet/minute.

Lithology



Materials Description

BASALT; Black; returns are a light gray powder.

CINDER Zone; color change to an amber to red brown powder; Basalt - black; concoidal fracture; hard; very few vesicles; passed through thin Cinder zone.

BASALT; color change to medium gray powder; hackly fracture; hard; dense

BASALT; light medium gray powder; somewhat friable, splintery fracture; orange-red iron staining on fractures.

BASALT; As above; cuttings are more pulverized; hackly frature, very dense; no vesicles.

CINDER Zone; red; dry.

CINDER Zone/BASALT (?); color change to gray red w/ flecks of white (ASH); dry; good returns; cuttings are a fine Silt to Clay size.

CINDER Zone; orange red to red brown; returns are so powdered that they almost entirely sift through strainer.

BASALT/CINDER Zone; gray red.

CINDER Zone; bright orange-red.

CINDER Zone; gray-red

CINDER Zone; bright orange; very soft.

BASALT/CINDER Zone (?); amber gray

BASALT/CINDER Zone (?); interbedded w/ Basalt

Black BASALT; hard; dense, hackly fracture.

Project Location IWP

Consultant Northern Engineering and Testing, Inc.

Total Depth 423

LOG OF BOREHOLE ANL-M6

Drilling Notes	Depth	Lithology	Materials Description
	300		
penetration rate approximately 0.5 feet/minute.			
penetration rate approximately 1.0 feet/minute.	310		BASALT; very vesicular.
			Black BASALT; hard; dense; few olivine crystals.
	320		Gray red BASALT;
			Black BASALT; hard; dense.
softer drilling; penetration rate approximately 1 ft/minute.			BASALT; as above - dry; good returns.
	330		
	340		Black BASALT; hard
drilling rate approximately 2 feet/minute.			BASALT; as above - very soft.
	350		
			CINDER Zone; red gray color; maybe thin interbeds.
			BASALT; reddish-gray; may be some thin Cinder zones; some vesicles.
much harder drilling; penetration rate of 1 ft/minute.	360		
soft drilling			BASALT; black; cuttings were initially moist, but dried rapidly - probably some seepage (?) from overnight.
penetration rate of 0.5 feet/minute; pull down pressure 6000#; air 1100 cfm.	370		BASALT; hard; concoidal fracture; succrosic.
penetration rate 1.0 feet/minute.	380		BASALT; black; hackly fracture; very vesicular.
	390		Crevice or void
Consistent drilling at 0.8 ft/min; pull down pressure 700#; 1100 cfm.			Lost circulation - no returns
No returns; pentration approximately 1 ft/min; 10,000# pull down pressure; 1100 cfm.	400		

Project Location IWP

Consultant Northern Engineering and Testing, Inc.

Total Depth 423

LOG OF BOREHOLE ANL-M6

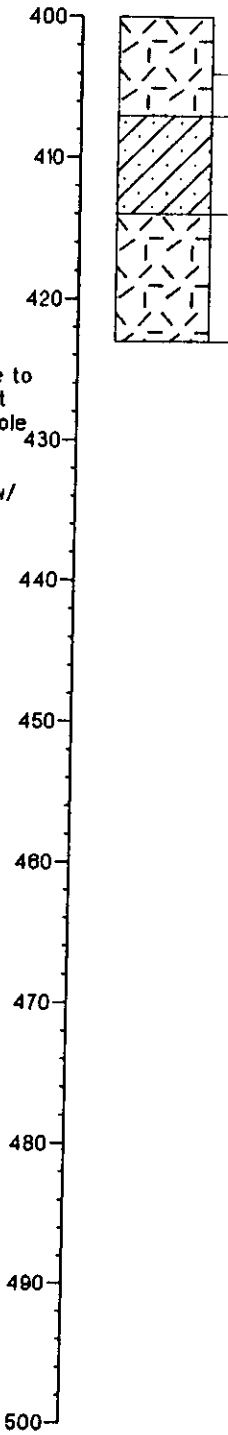
Drilling Notes

0 pull down pressure; no returns.

firm drilling

14 november 1987 12:00 - Tripped out of hole to allow USGS to run logs and evaluate sediment interbed. 14:00 - Moved workover rig over hole and installed 404' of tremie pipe and 2' subsection; backfilled with silica sand to approximately 412 and then filled up to 406 w/ bentonite.

Lithology



Materials Description

BASALT; As above.

Sediment interbed; dark tan to light brown; no returns.

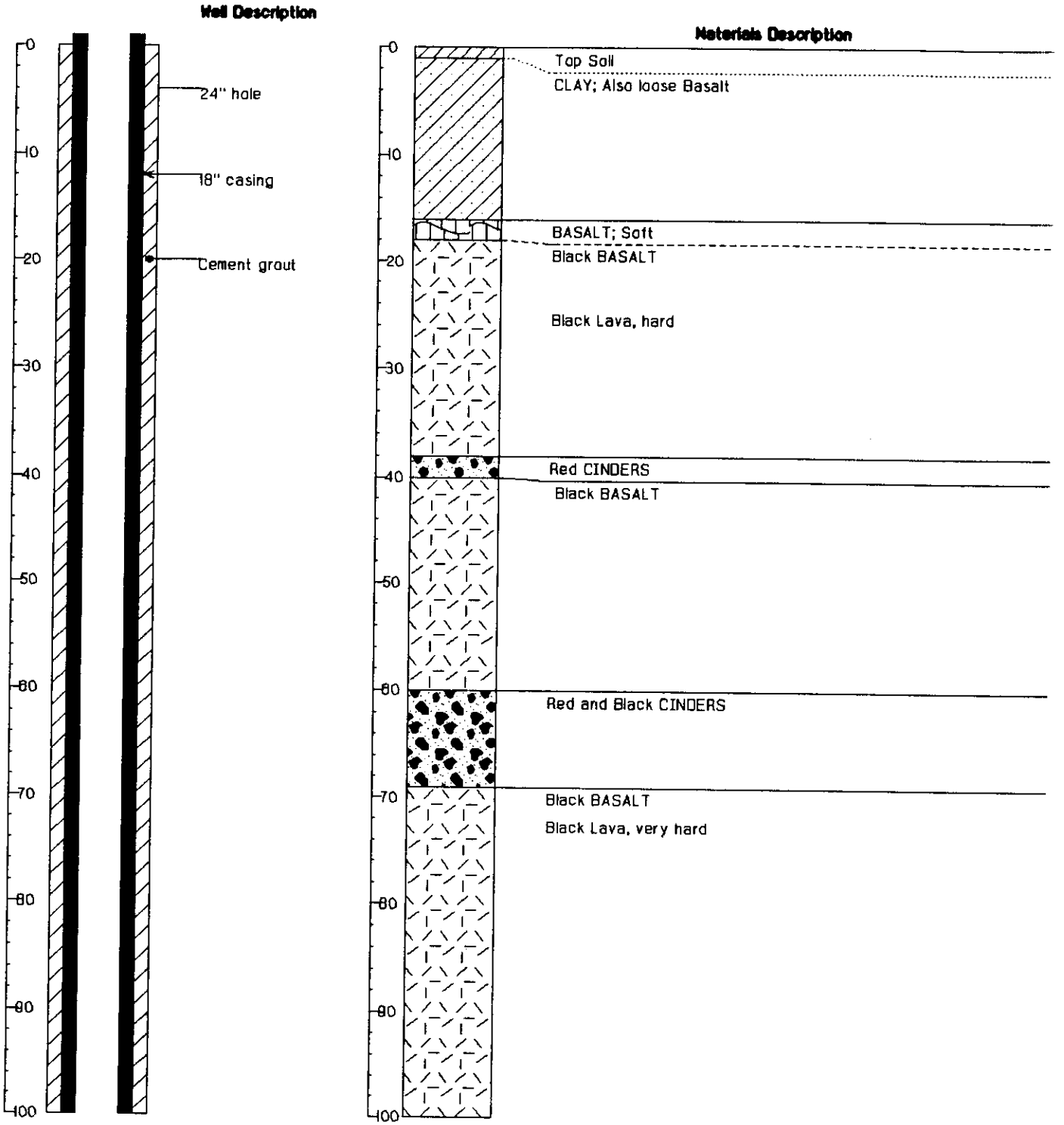
BASALT; As above

LOG OF WELL EBR-II No. 1

Project Location EBR-II Construction

Driller Building 754

Total Depth Cushman and Johnson



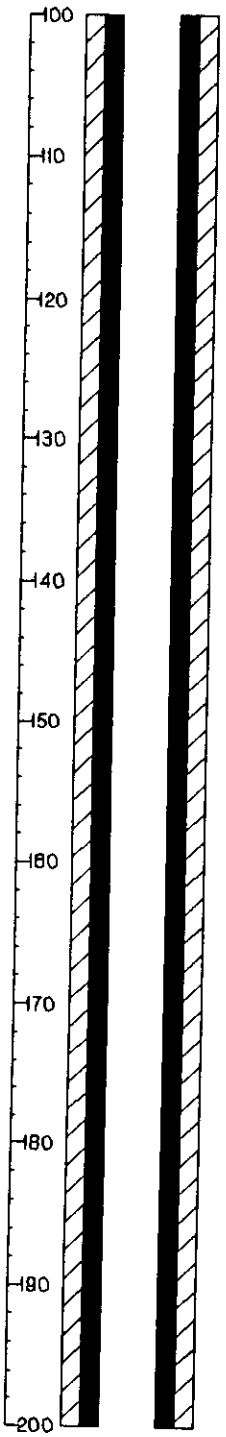
LOG OF WELL EBR-II No. 1

Project Location EBR-II Construction

Driller Building 754

Total Depth Cushman and Johnson

Well Description



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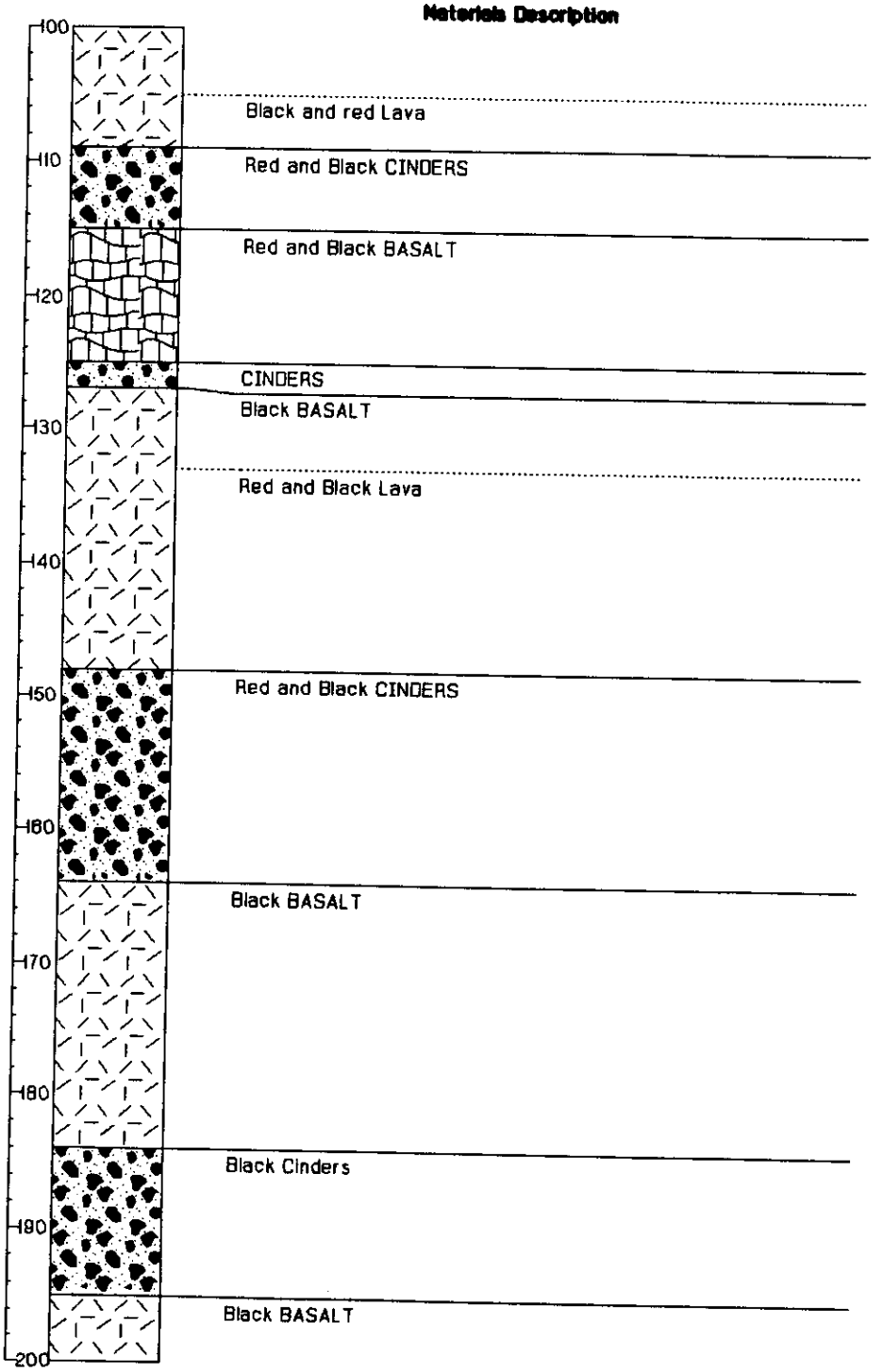


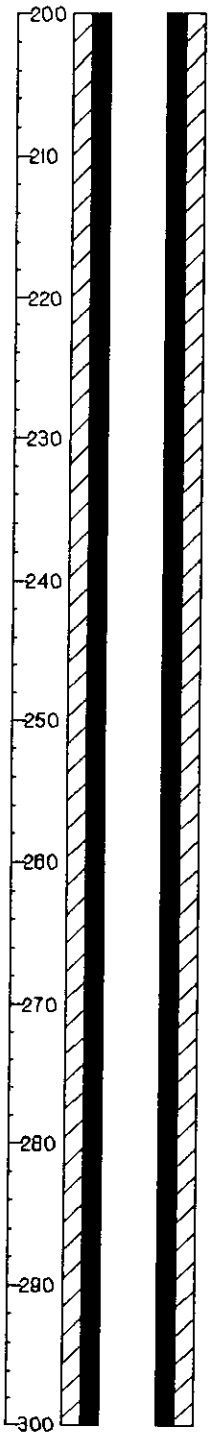
LOG OF WELL EBR-II No. 1

Project Location EBR-II Construction

Driller Building 754

Total Depth Cushman and Johnson

Well Description



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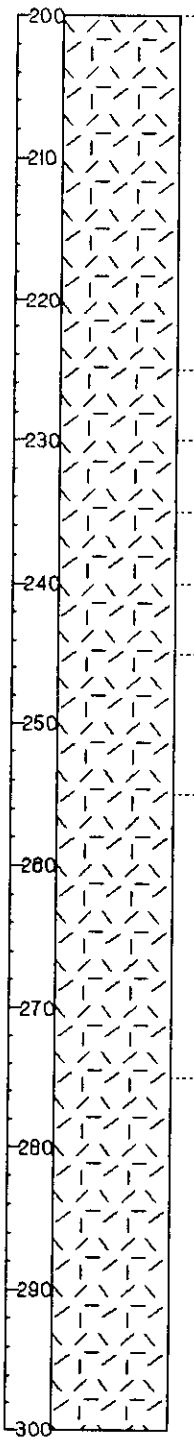


Hard Black Lava

Black Lava

Gray Lava

Hard Black Lava

Gray Lava

Red and Black Lava

Red Lava, hard

Red Lava, harder

Black Lava

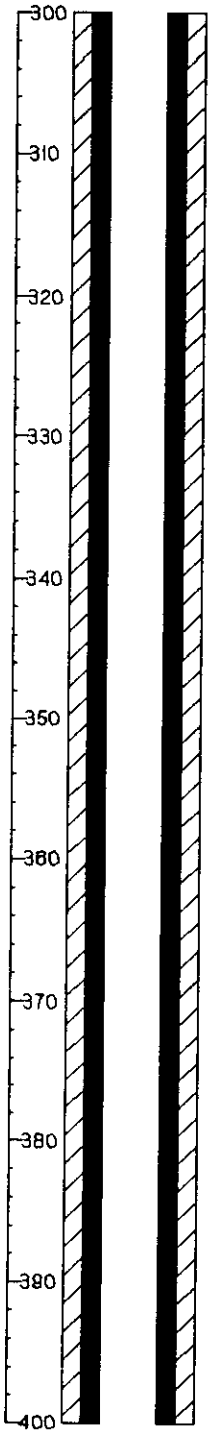
LOG OF WELL EBR-II No. 1

Project Location EBR-II Construction

Driller Building 754

Total Depth Cushman and Johnson

Well Description



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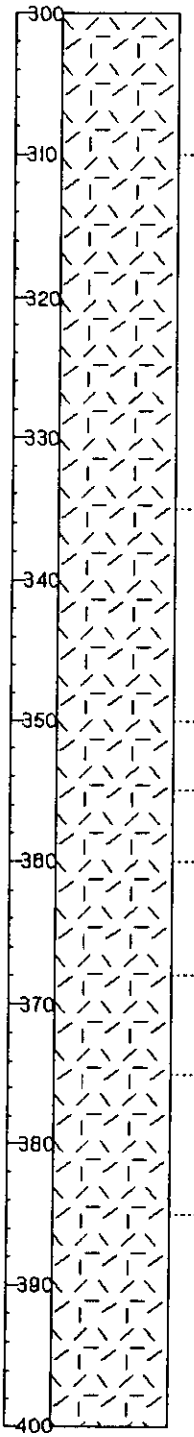


Red and Black Lava

Black and Red Lava

Red and Black Lava

Black Lava

Black and Red Lava

Black Lava

Black and Red Lava

Red and Black Lava

Black Lava

Black and Red Lava

Black Lava

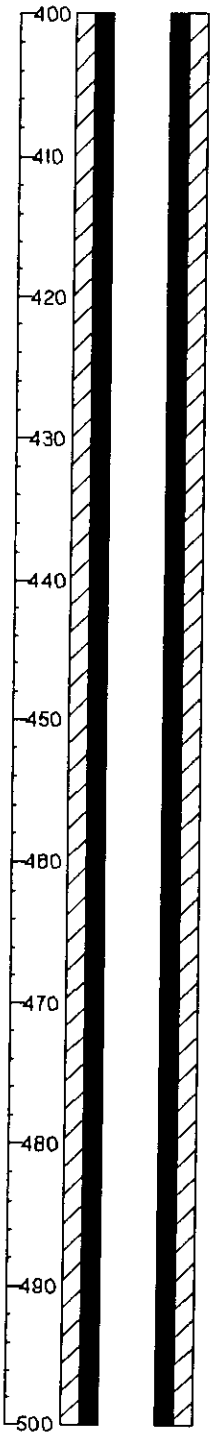
LOG OF WELL EBR-II No. 1

Project Location EBR-II Construction

Driller Building 754

Total Depth Cushman and Johnson

Well Description



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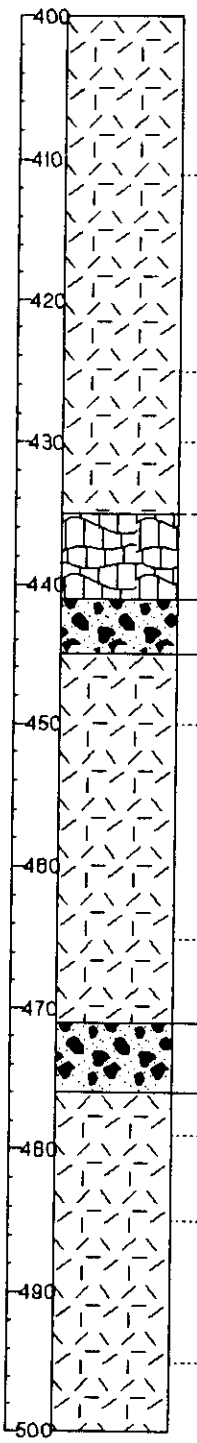


Red and Black Lava

Black Lava, hard

Red and Black Lava

Red and Black BASALT; with streaks of red CINDERS

Black CINDERS

Black BASALT

Red and Black Lava

Black Lava

Black CINDERS

Black BASALT

Red Lava

Red and Black Lava

Hard

Black Lava

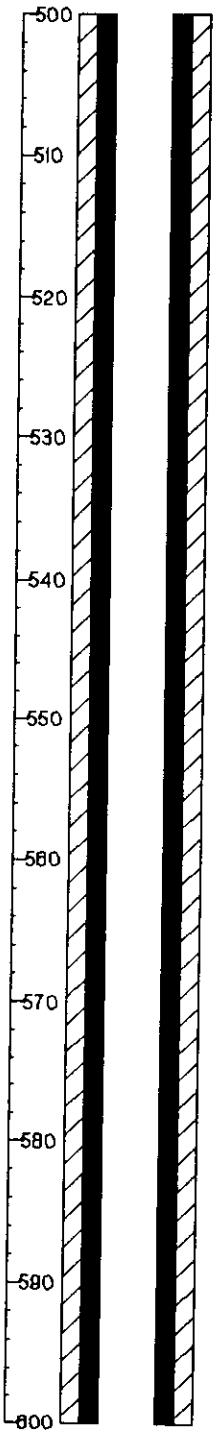
LOG OF WELL EBR-II No. 1

Project Location EBR-II Construction

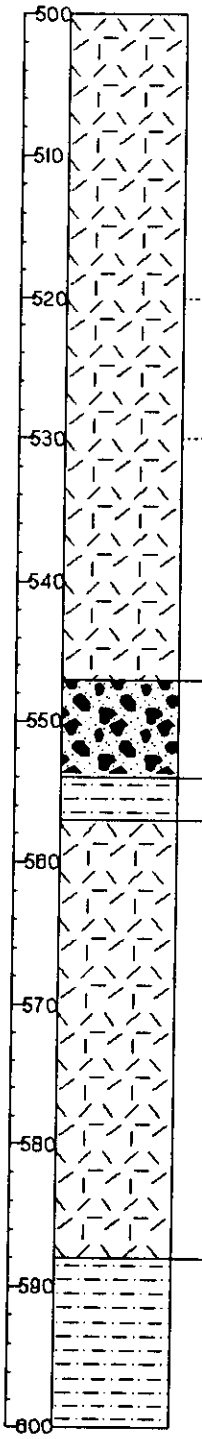
Driller Building 754

Total Depth Cushman and Johnson

Well Description



Materials Description



Hard Black Lava

Black Lava and some red, very hard

Black Lava

Black and red Lava

Black Lava

CINDERS

Brown CLAY; Soft (and Cinders from above)

BASALT

Black Lava

Brown CLAY

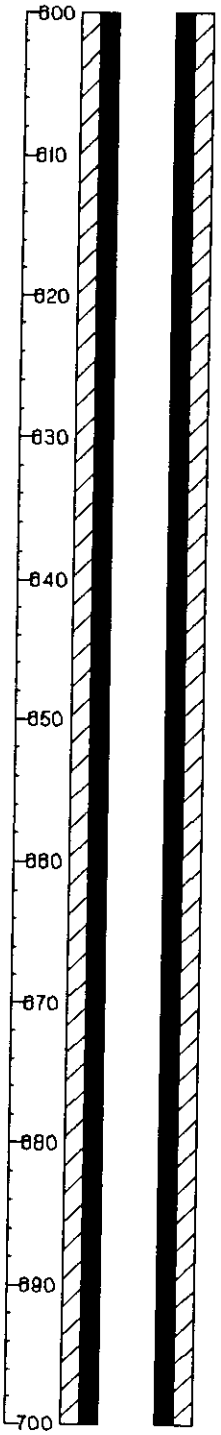
LOG OF WELL EBR-II No. 1

Project Location EBR-II Construction

Driller Building 754

Total Depth Cushman and Johnson

Well Description



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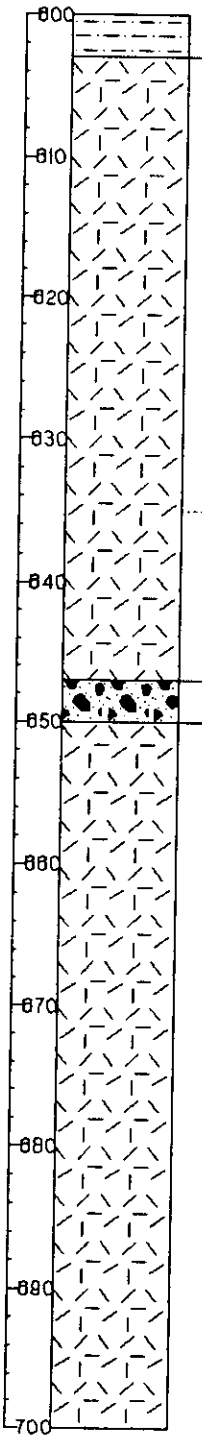


Black BASALT

Black Lava, some red

Black and red Lava

CINDERS; First water

Black BASALT

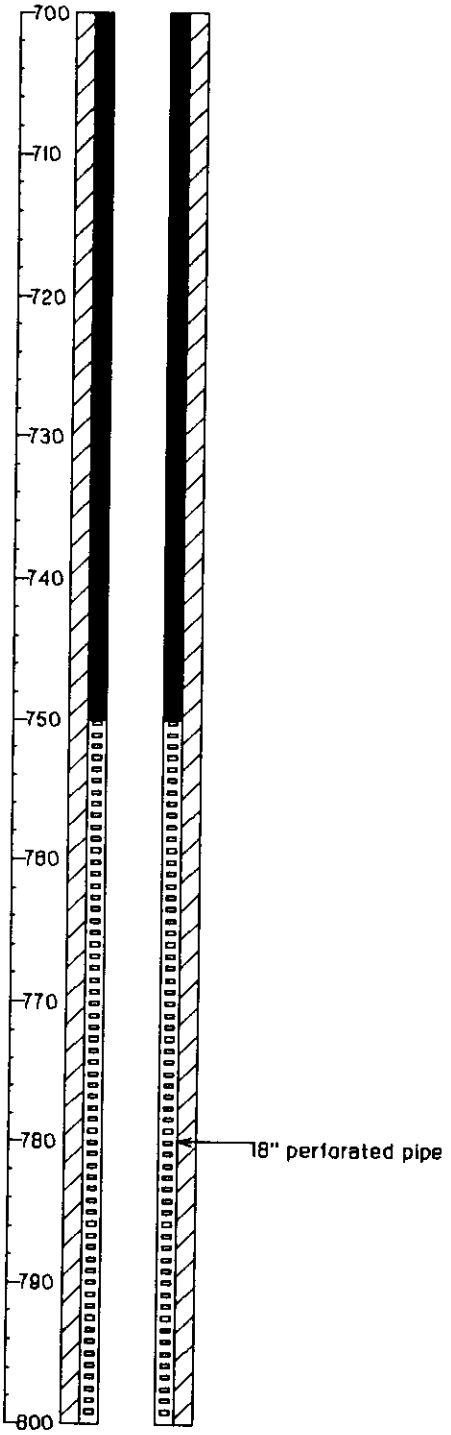
LOG OF WELL EBR-II No. 1

Project Location EBR-II Construction

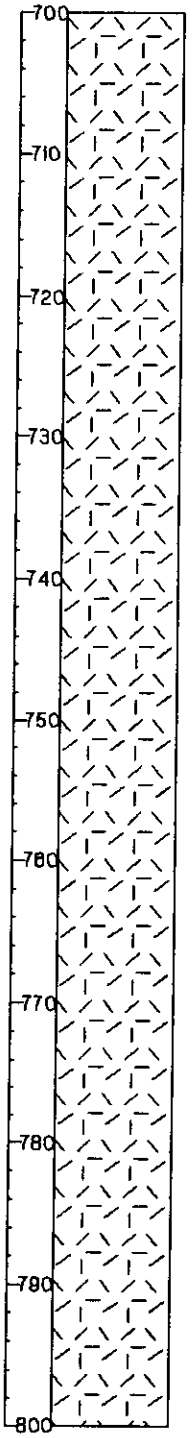
Driller Building 754

Total Depth Cushman and Johnson

Well Description



Materials Description



Black Lava

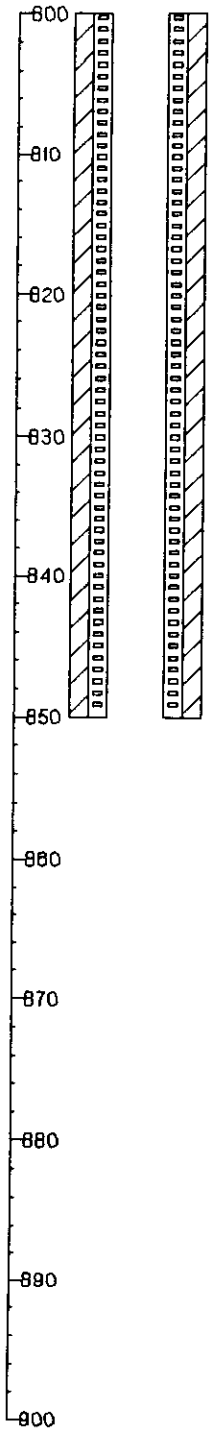
LOG OF WELL EBR-II No. 1

Project Location EBR-II Construction

Driller Building 754

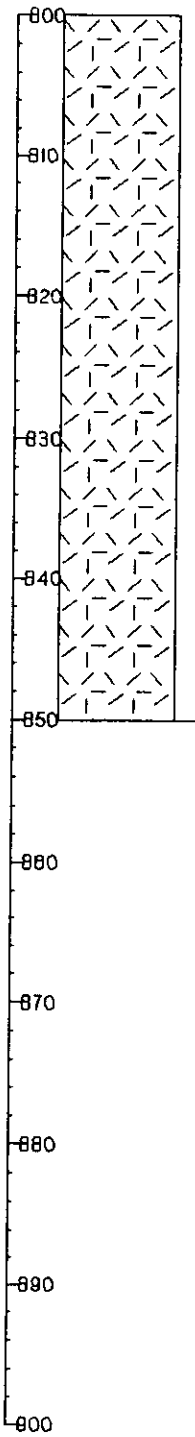
Total Depth Cushman and Johnson

Well Description



NOTE: Drillers log shows depth of TD of 743' Contract shows completion depth of 850', with 100' of perforated pipe from 750' to 850'

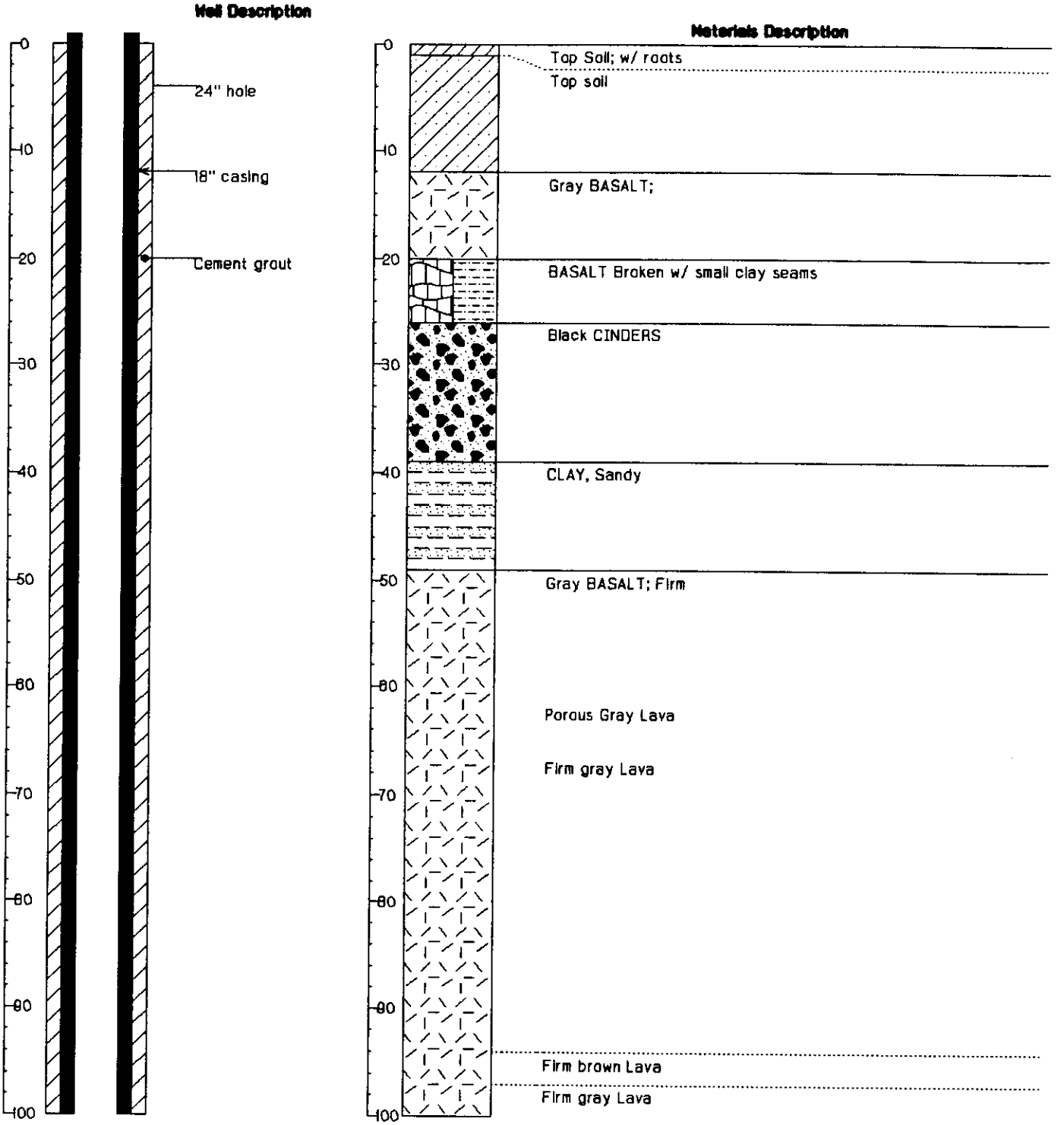
Materials Description



Black Lava

LOG OF WELL EBR-II No. 2

Project Location: EBR-II Construction
Driller: Building 758
Total Depth: Andrews Well Drilling



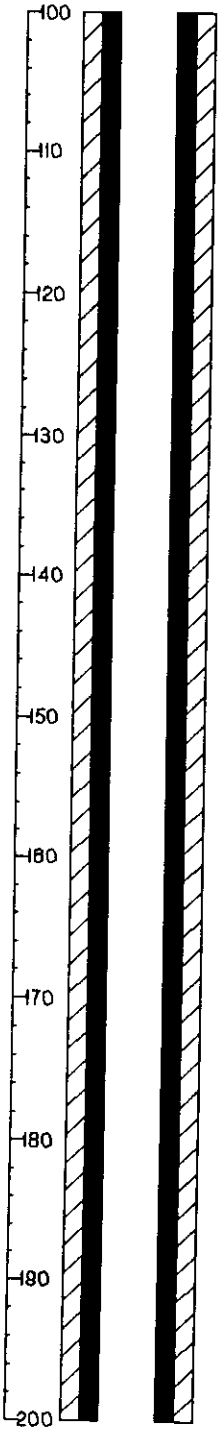
LOG OF WELL EBR-II No. 2

Project Location EBR-II Construction

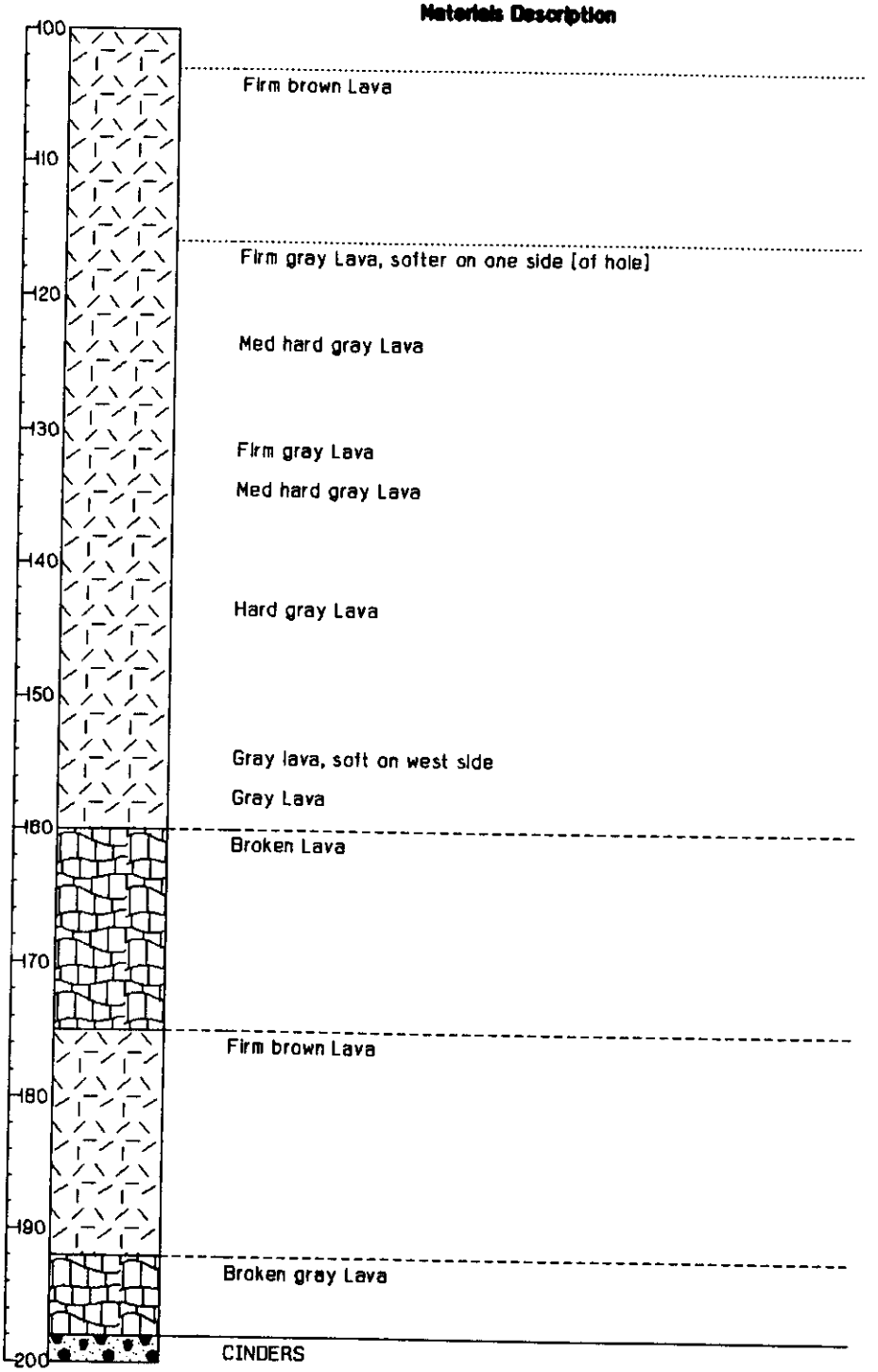
Driller Building 758

Total Depth Andrews Well Drilling

Well Description



Materials Description



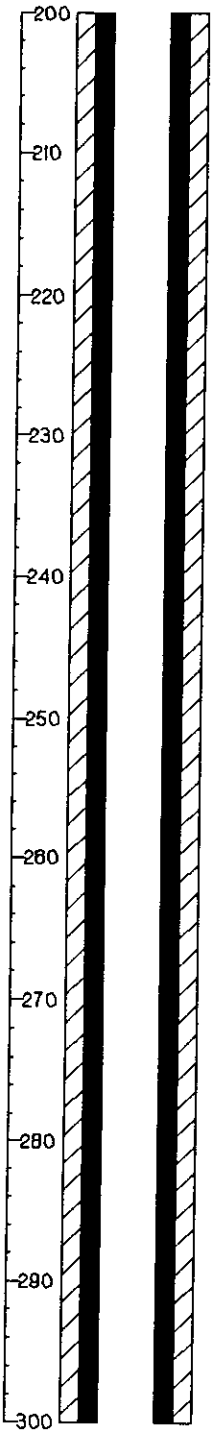
LOG OF WELL EBR-II No. 2

Project Location EBR-II Construction

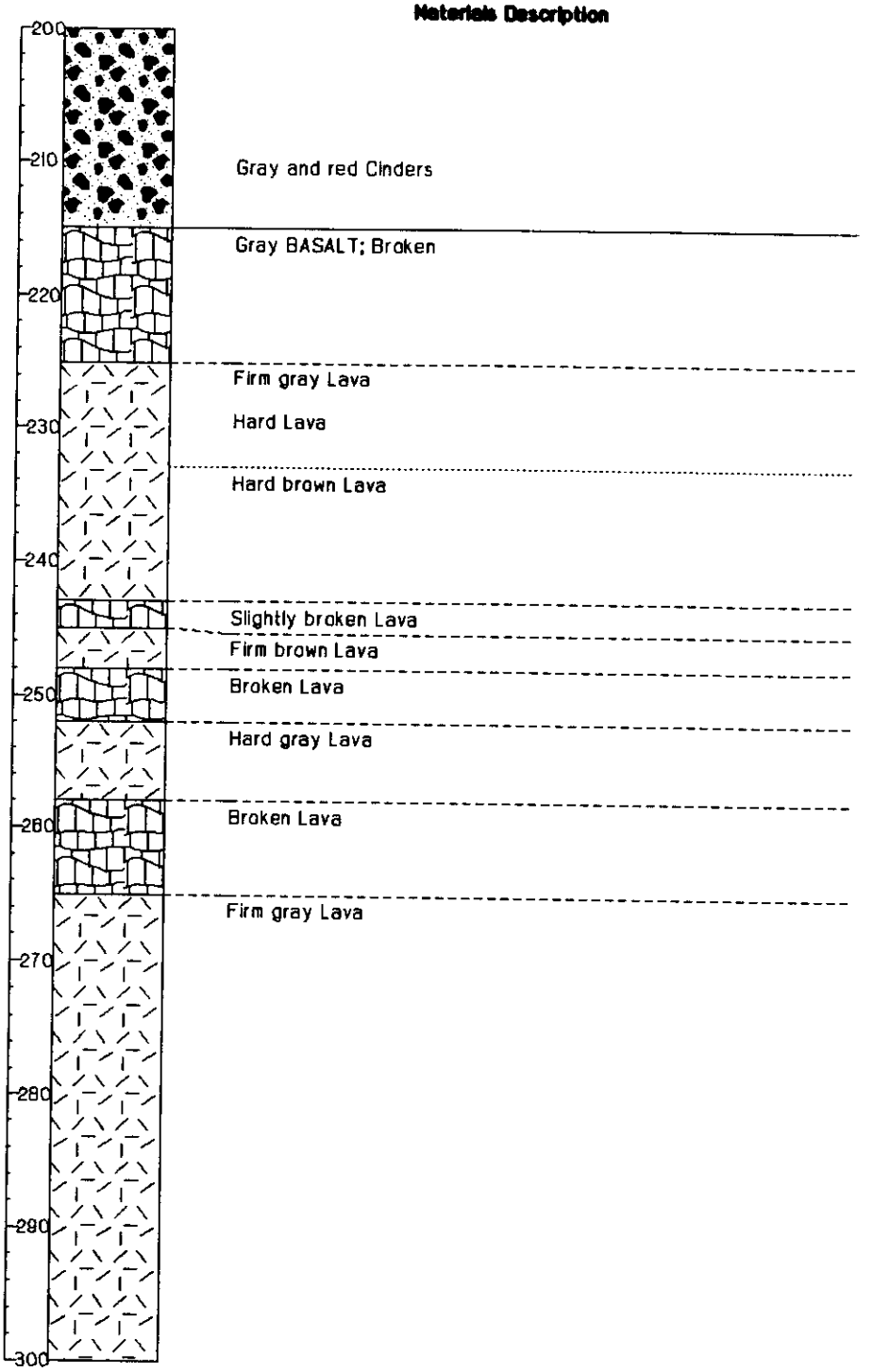
Driller Building 758

Total Depth Andrews Well Drilling

Well Description



Materials Description



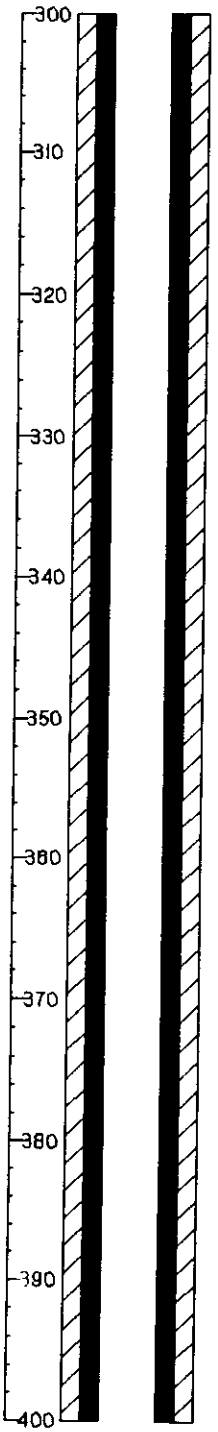
LOG OF WELL EBR-II No. 2

Project Location EBR-II Construction

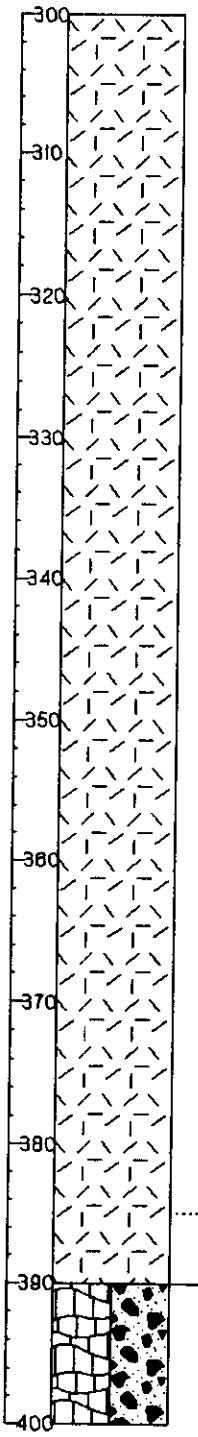
Driller Building 756

Total Depth Andrews Well Drilling

Well Description



Materials Description



Hard gray Lava

Firm brown Lava

Brown BASALT; mixed with Lava ASH

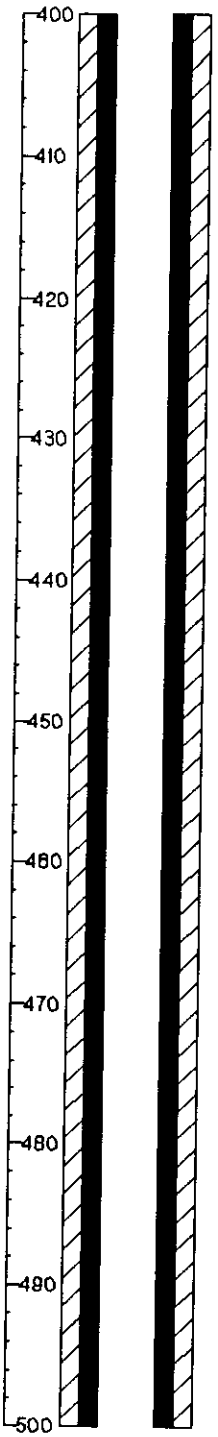
LOG OF WELL EBR-II No. 2

Project Location EBR-II Construction

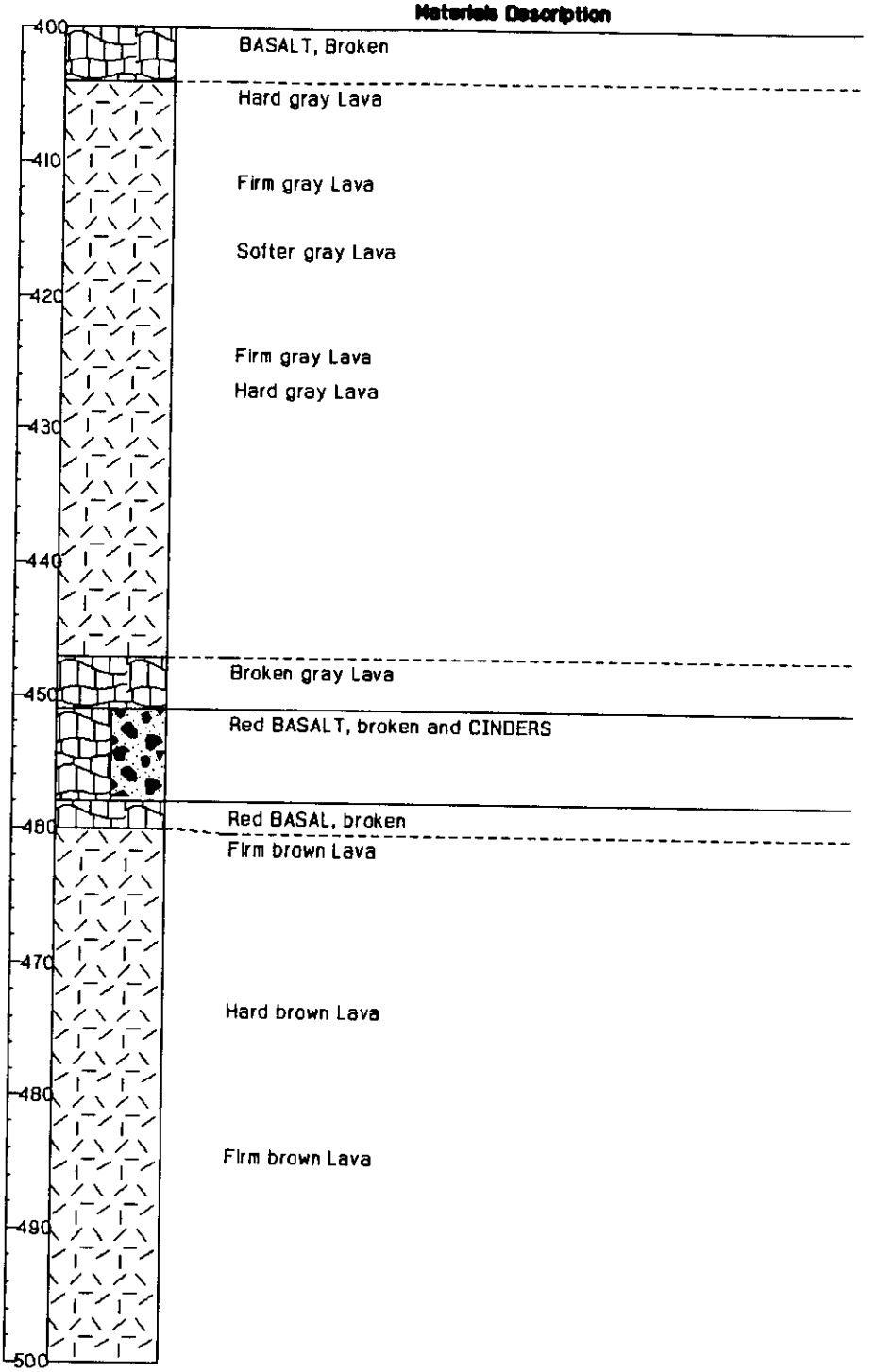
Driller Building 758

Total Depth Andrews Well Drilling

Well Description



Materials Description



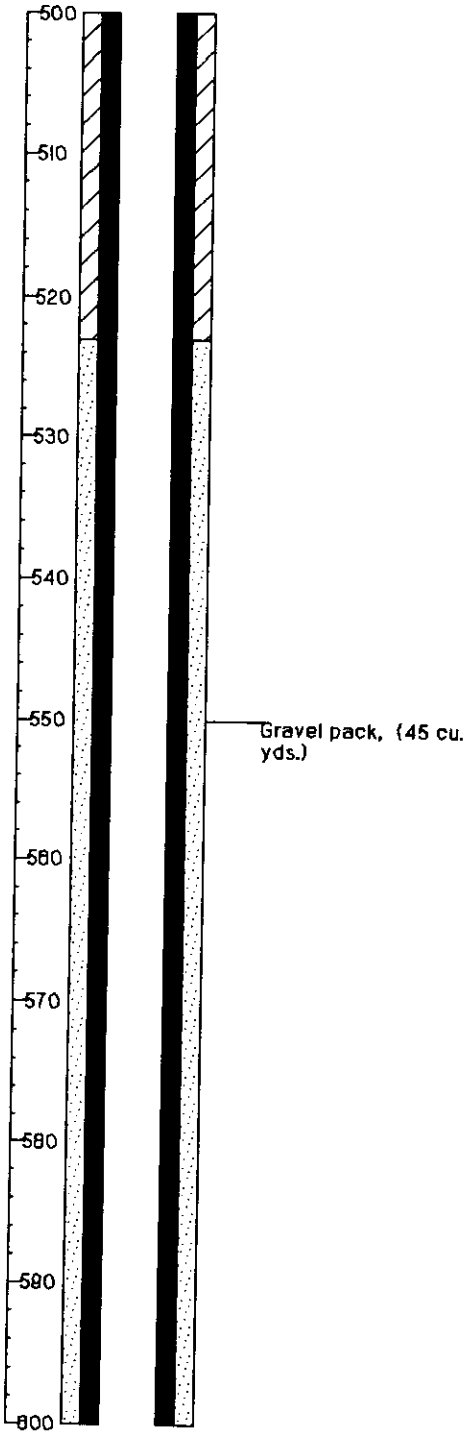
LOG OF WELL EBR-II No. 2

Project Location EBR-II Construction

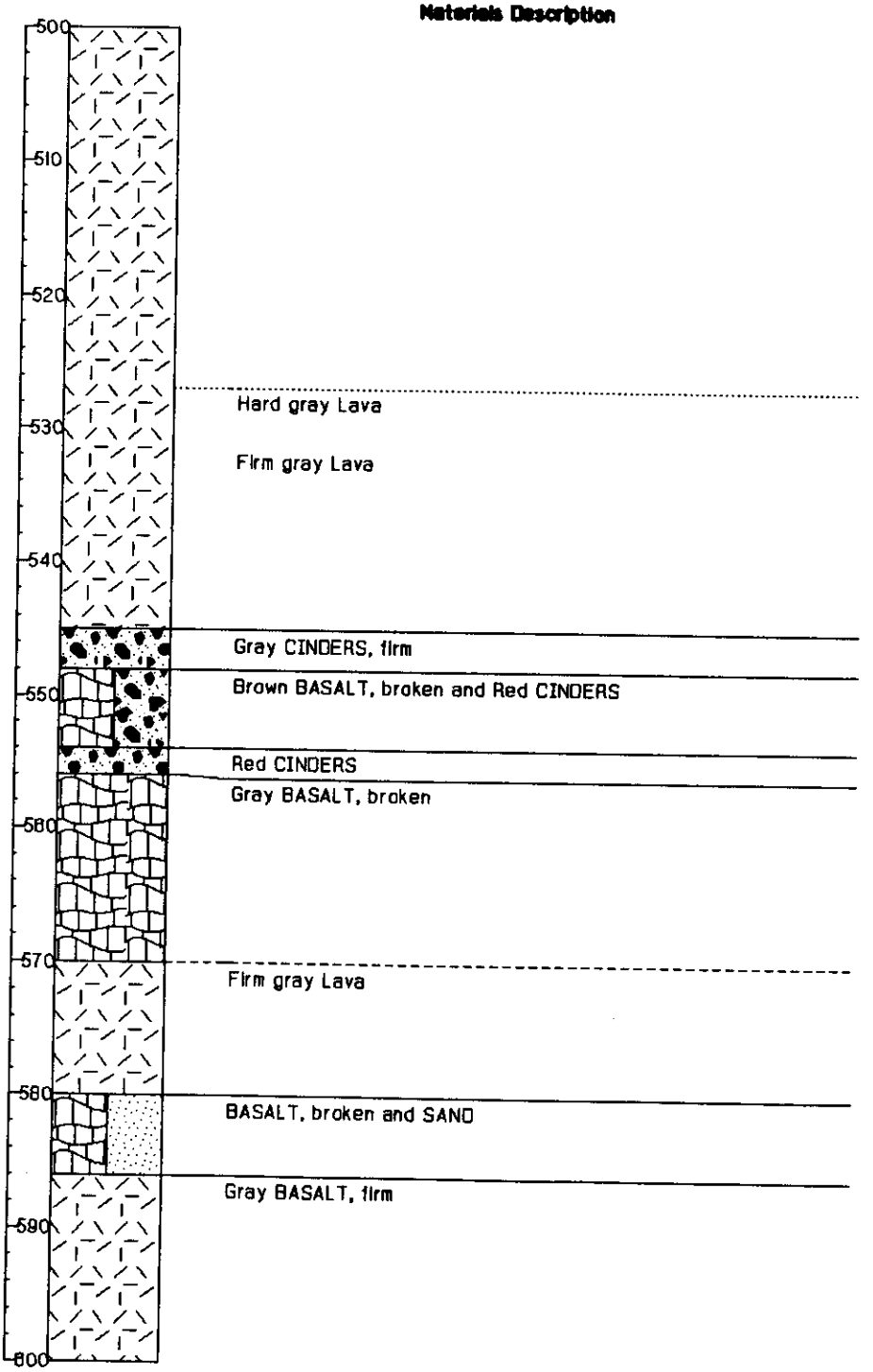
Driller Building 758

Total Depth Andrews Well Drilling

Well Description



Materials Description



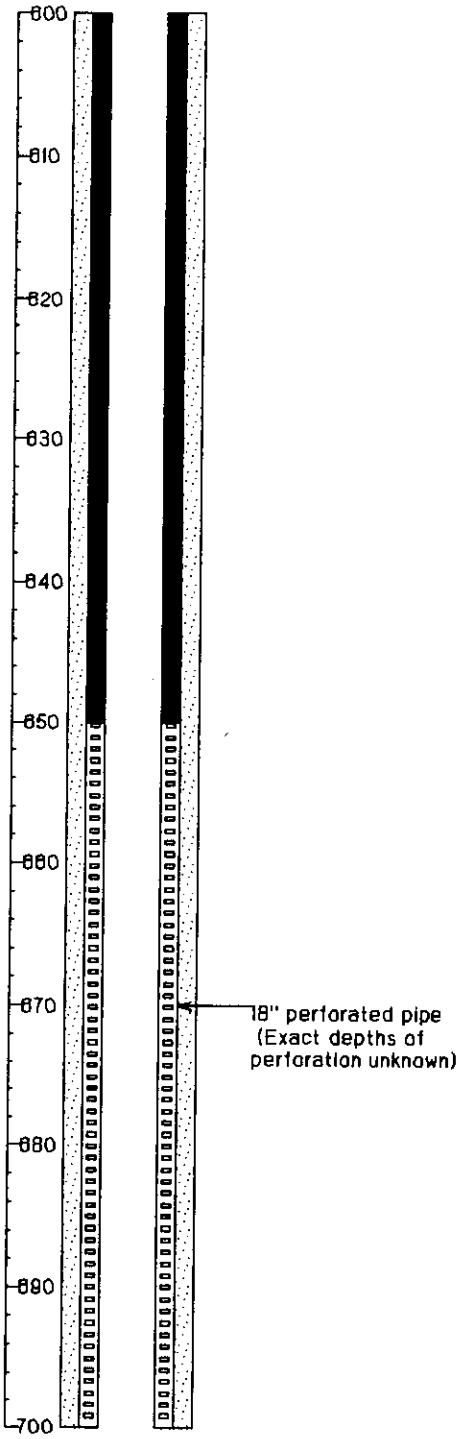
LOG OF WELL EBR-II No. 2

Project Location EBR-II Construction

Driller Building 758

Total Depth Andrews Well Drilling

Well Description



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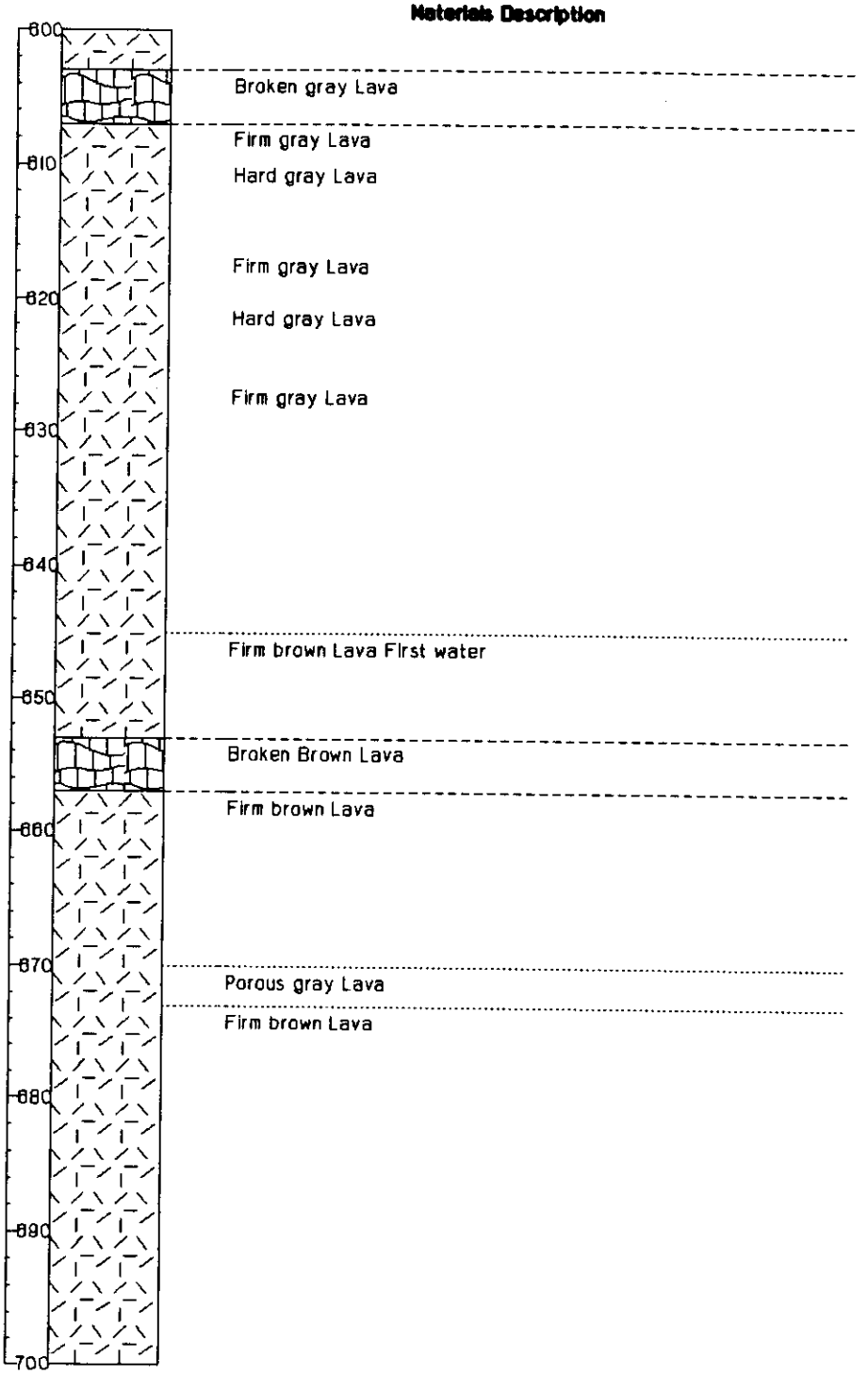


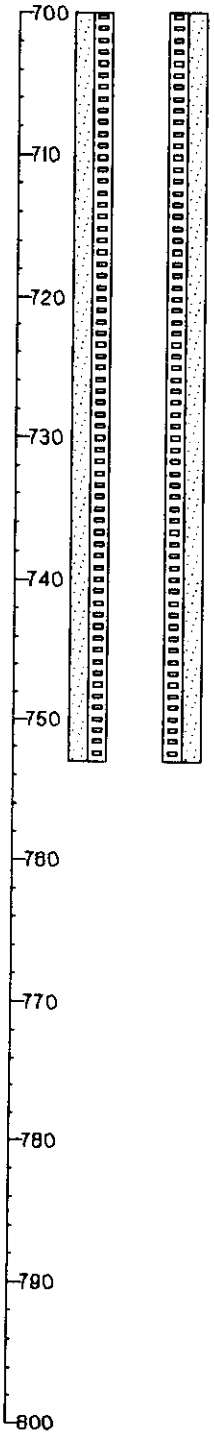
LOG OF WELL EBR-II No. 2

Project Location EBR-II Construction

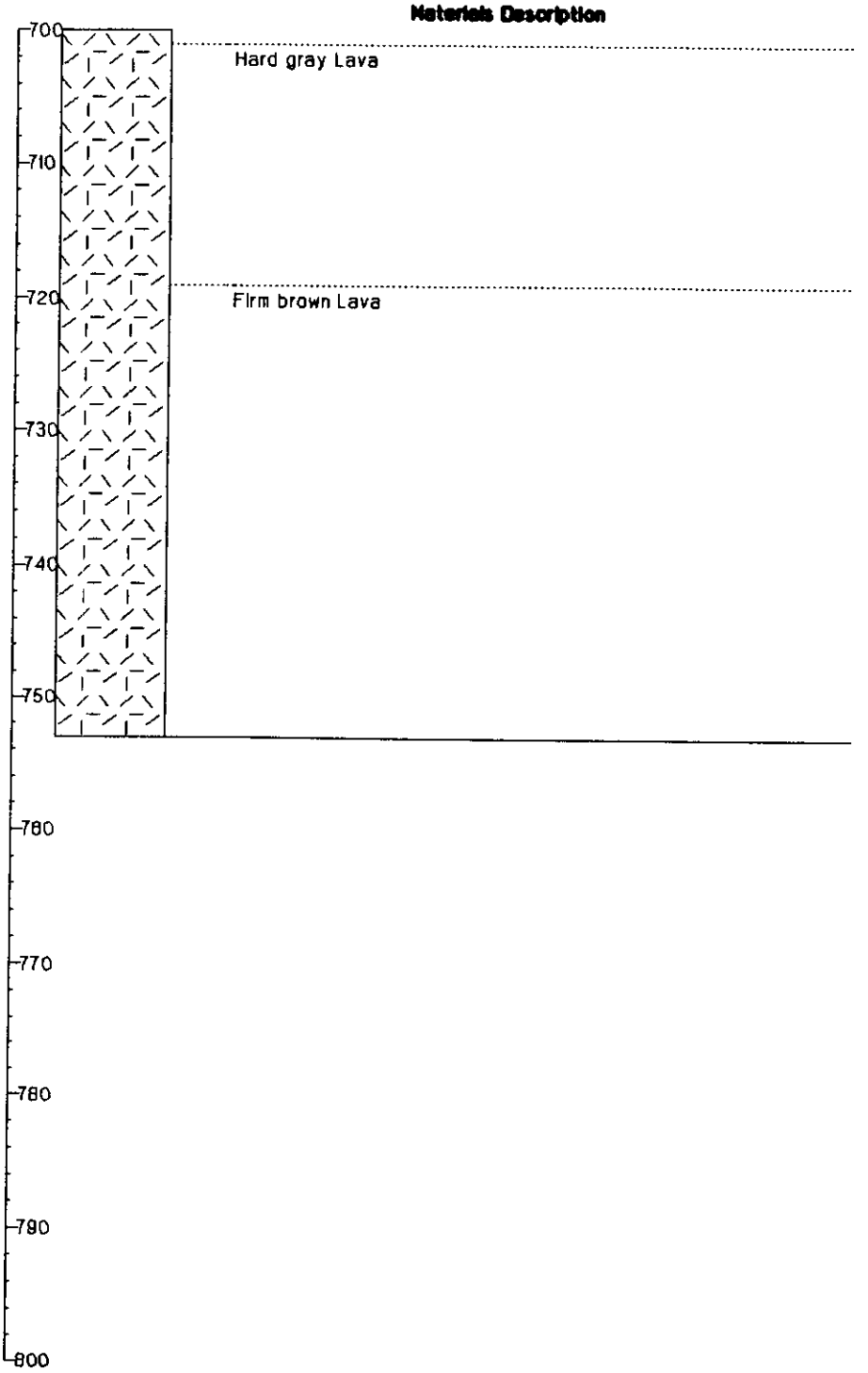
Driller Building 758

Total Depth Andrews Well Drilling

Well Description



Materials Description

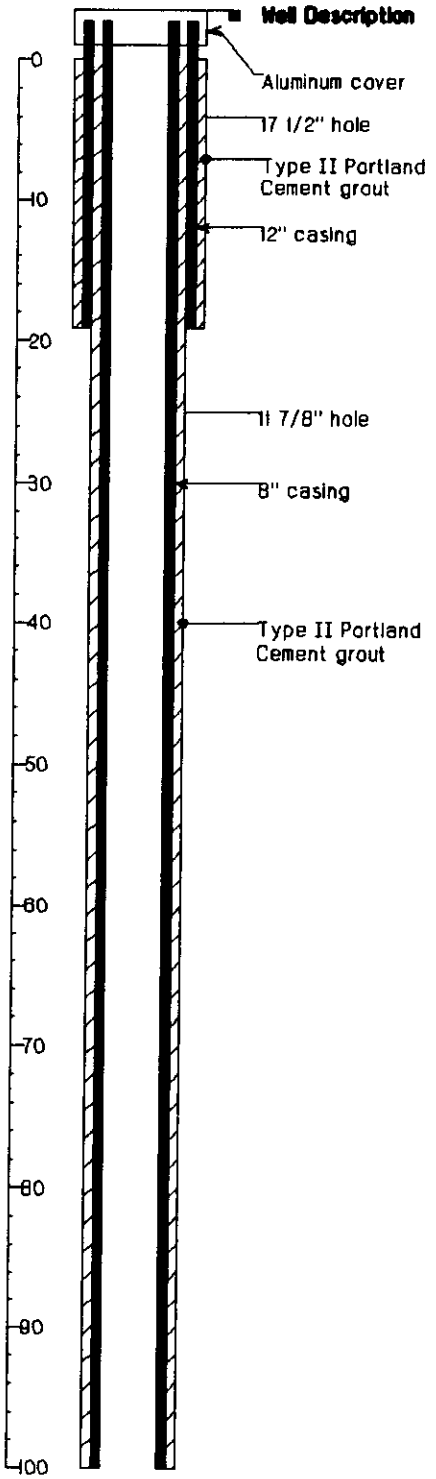


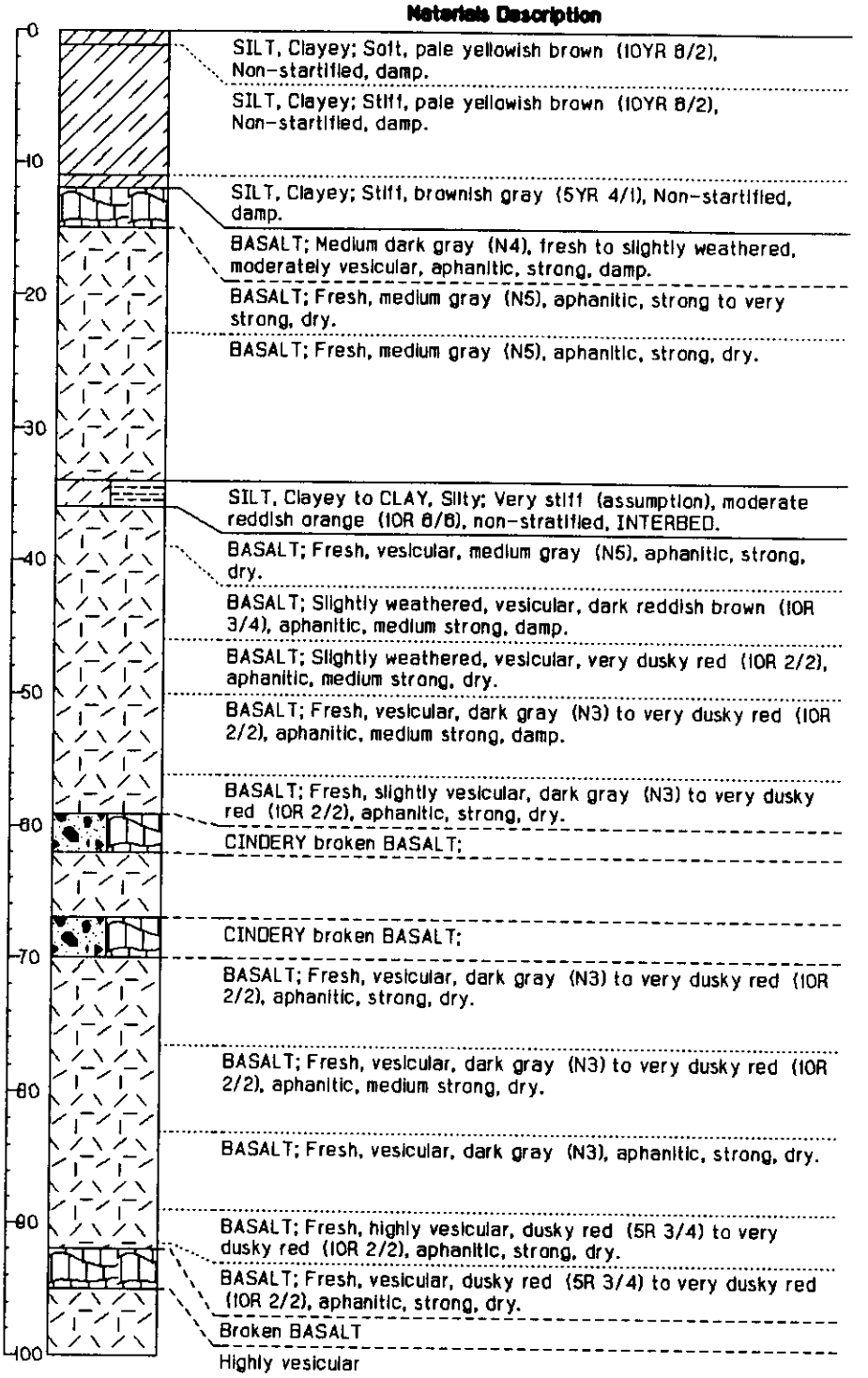
LOG OF WELL ANL-MON-A-11

Project Location: EBR-II Leach Pit Characterization

Driller: SW of Leach pit

Total Depth: Hawley Brothers





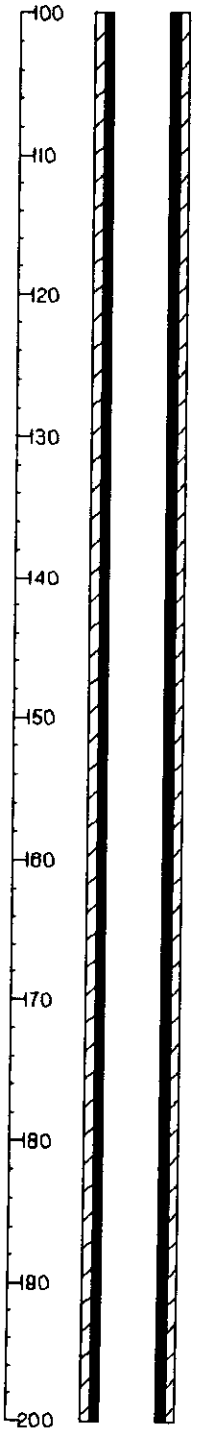
LOG OF WELL ANL-MON-A-11

Project Location EBR-II Leach Pit Characterization

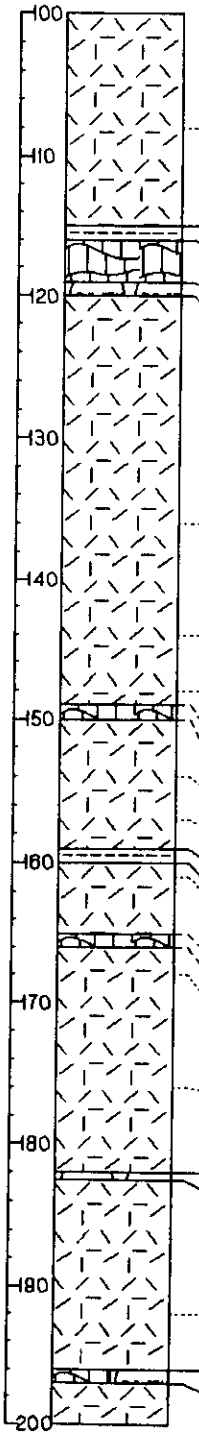
Driller SW of Leach pit

Total Depth Hawley Brothers

Well Description



Materials Description



BASALT; Fresh, vesicular, very dusky red (10R 3/4) to dark gray (N3), aphanitic, strong, dry.

INTERBED

BASALT; Fresh, highly vesicular, medium dark gray (N4) to dark gray (N3), aphanitic, strong, dry.

Void

BASALT; Fresh, vesicular, medium dark gray (N4) to dark gray (N3), aphanitic, strong, dry.

BASALT; Fresh, slightly vesicular to massive, medium dark gray (N4) to dark gray (N3), aphanitic, strong, dry.

BASALT; Fresh, vesicular, medium dark gray (N4) to dark gray (N3), aphanitic, medium strong, dry.

BASALT; (Cinders) Fresh, vesicular, slightly weathered, pale reddish brown (10R 5/4) to dark reddish brown (10R 3/4), aphanitic, medium strong, dry.

Broken BASALT

Large fractures, some sediment

BASALT; Fresh, medium dark gray (N4), medium strong, dry.

Interbed

BASALT; Fresh, moderately vesicular, dark medium gray (N4), medium strong to strong, dry.

Broken BASALT

slightly vesicular

BASALT; Fresh to slightly weathered, highly vesicular, medium gray (N4) to dusky red (5R 3/4), medium strong, dry.

BASALT; Fresh, massive, medium gray (N5), very strong, dry.

Possible void

Vertical fracture 182.5'-185'

BASALT; Fresh, slightly vesicular, medium gray (N5), strong, dry.

Possible void or broken Basalt

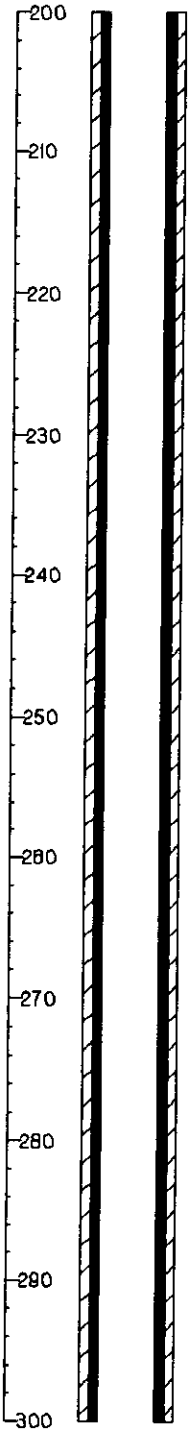
LOG OF WELL ANL-MON-A-11

Project Location EBR-II Leach Pit Characterization

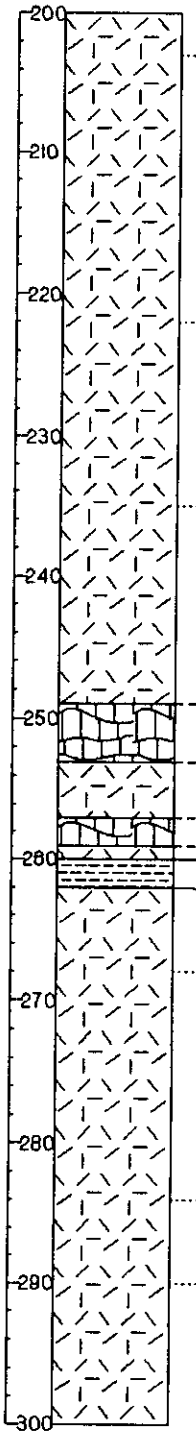
Driller SW of Leach pit

Total Depth Hawley Brothers

Well Description



Materials Description



BASALT; Fresh, vesicular to highly vesicular, medium gray (N5), aphanitic medium strong, dry.

Highly vesicular to vertical fractures, 208'-212'

Moderately vesicular, 212'-214'

Highly vesicular to vertical fractures, 214'-222'

BASALT; Fresh, slightly vesicular, medium gray (N5), strong, dry.

Several large vesicles, small lava tubes

Large vertical fracture, 227'-231'

BASALT; Fresh, slightly to moderately vesicular, medium gray (N5), medium strong, dry.

Highly vesicular, 244'-248'

Broken BASALT

BASALT; Fresh, vesicular, medium gray (N5), medium strong, dry.

Broken BASALT

INTERBED

BASALT; Fresh, highly vesicular to vesicular, medium gray (N5), medium strong, dry.

BASALT; Fresh, slightly vesicular to vesicular, medium gray (N5) to pale red (5R 6/2), aphanitic to slightly phaneritic, strong, dry

BASALT; Fresh, massive, medium gray (N5) to pale red (5R 6/2) medium strong, dry.

BASALT; Fresh, massive, medium dark gray (N4), aphanitic, strong, dry.

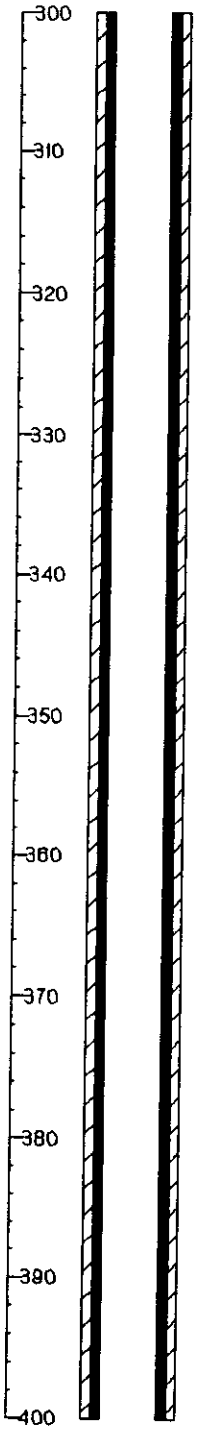
LOG OF WELL ANL-MON-A-11

Project Location EBR-II Leach Pit Characterization

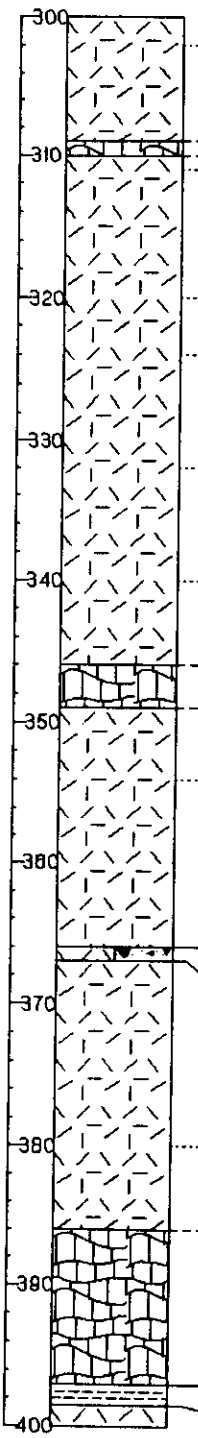
Driller SW of Leach pit

Total Depth Hawley Brothers

Well Description



Materials Description



BASALT; Fresh, slightly vesicular to vesicular, medium dark gray (N4) to dusky red (5R 3/4), aphanitic, medium strong, dry.

Broken BASALT

BASALT; Fresh, vesicular, medium dark gray (N4) to dusky red (5R 3/4), aphanitic, medium strong, dry.

BASALT; Fresh, vesicular, medium dark gray (N4), aphanitic, medium strong dry.

BASALT; Fresh, slightly vesicular, medium dark gray (N4), aphanitic, medium strong, dry.

BASALT; Fresh, massive, medium dark gray (N4), aphanitic, strong, dry.

BASALT; Fresh, medium dark gray (N4), aphanitic, strong, dry.

Broken BASALT

BASALT; Fresh, vesicular, dusky red (5R 3/4), aphanitic, medium strong to weak, dry.

BASALT; Fresh, slightly vesicular, medium dark gray (N4), aphanitic, medium strong, dry.

BASALT; (Cinders) Fresh, highly vesicular, dusky red (5R 3/4), aphanitic, medium strong to weak, dry, some sediment.

BASALT; Fresh, slightly vesicular, medium dark gray (N4), aphanitic, medium strong, dry.

BASALT; Fresh, vesicular, medium dark gray (N4), aphanitic, medium strong dry.

BASALT; Fresh, vesicular, medium dark gray (N4), aphanitic, weak, dry, broken zone.

INTERBED

BASALT; Fresh, highly vesicular, medium dark gray (N4), aphanitic, medium strong, dry.

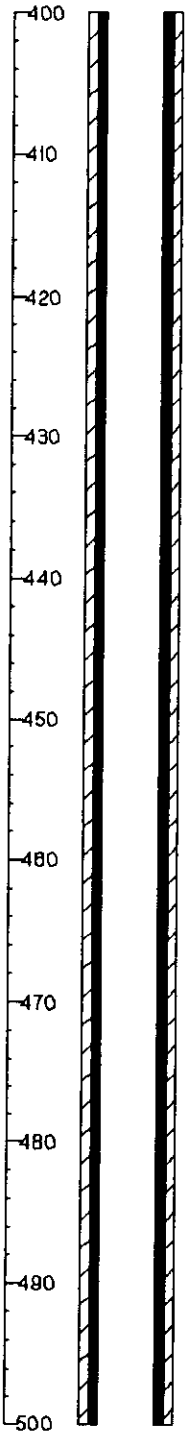
LOG OF WELL ANL-MON-A-11

Project Location EBR-II Leach Pit Characterization

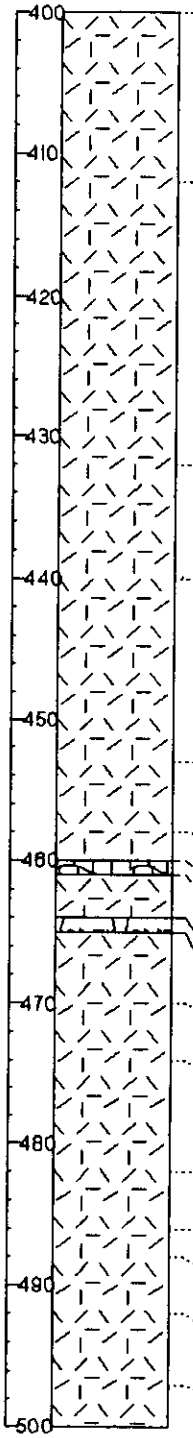
Driller SW of Leach pit

Total Depth Hawley Brothers

Well Description



Materials Description



BASALT; Fresh, slighly vesicular to vesicular, medium dark gray (N4), aphanitic, medium strong, dry.

BASALT; Fresh, vesicular, medium dark gray (N4), aphanitic, medium strong, dry.

BASALT; Fresh, slightly vesicular to vesicular, medium dark gray (N4), aphanitic, medium strong, dry.

BASALT; Fresh, slightly vesicular, medium dark gray (N4), aphanitic, aphanitic, medium strong, dry.

BASALT; Fresh to slightly weathered, vesicular, very dusky red (10R 2/2), aphanitic to slightly phaneritic, medium strong to weak, dry.

BASALT; Fresh, vesicular, very dusky red (10R 2/2) to dark gray (N3), aphanitic, medium strong, dry.

Broken BASALT

BASALT; Fresh, vesicular, medium dark gray (N4), aphanitic, medium strong dry.

Small void across borehole

BASALT; Fresh, vesicular to slightly vesicular, medium dark gray (N4), aphanitic, strong, dry.

BASALT; Fresh, vesicular to slightly vesicular, very dusky red (10R 2/2), aphanitic, medium strong to weak, dry.

BASALT; Fresh, vesicular to highly vesicular, medium dark gray (N4) to dark gray (N3), aphanitic, medium strong, dry.

BASALT; Fresh, vesicular, medium dark gray (N4), aphanitic, strong, dry.

BASALT; Fresh, vesicular to slightly vesicular, medium dark gray (N4), aphanitic, medium strong to weak, dry.

BASALT; Fresh, slightly vesicular to vesicular, medium dark gray (N4) to dark gray (N3), aphanitic, strong, dry.

BASALT; Fresh, slightly vesicular, medium dark gray (N4) to dark gray (N3) aphanitic, strong, dry.

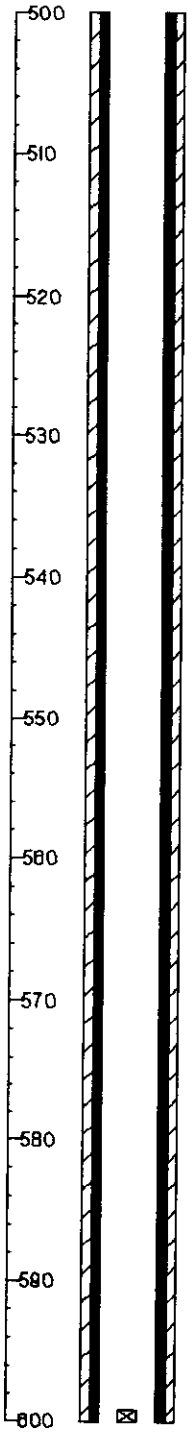
LOG OF WELL ANL-MON-A-11

Project Location EBR-II Leach Pit Characterization

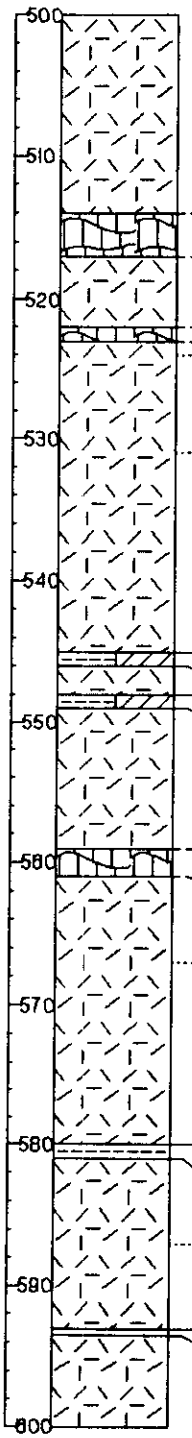
Driller SW of Leach pit

Total Depth Hawley Brothers

Well Description



Materials Description



Broken BASALT

BASALT; Fresh, vesicular, medium dark gray (N4), aphanitic, medium strong dry.

Broken BASALT

BASALT; Fresh, vesicular, medium dark gray (N4) to dark gray (N3), aphanitic, medium strong to strong, dry.

BASALT; Fresh, slightly vesicular, medium dark gray (N4) to dark gray (N3) aphanitic, medium strong to strong, dry.

CLAY, Silty to SILT, Clayey; Dark yellowish orange (10YR 6/6)

CLAY, Silty to SILT, Clayey; Dark yellowish orange (10YR 6/6)

BASALT; Fresh, vesicular, medium dark gray (N4) to dark gray (N3) aphanitic, medium strong to strong, dry.

Broken BASALT

BASALT; Fresh, vesicular, medium dark gray (N4) to dark gray (N3) aphanitic, strong to medium strong, dry.

BASALT; Fresh, slightly vesicular, medium dark gray (N4) to dark gray (N3), aphanitic, strong, dry.

CLAY, Silty; Interbed – description from split spoon sample Dark yellowish orange (10YR 6/6), well sorted, non-stratified.

BASALT; Fresh, vesicular, dark gray (N3), aphanitic, strong, dry.

BASALT; Fresh, slightly vesicular to vesicular, medium dark gray (N4) to to dark gray (N3), aphanitic to slightly phaneritic, strong to medium strong, dry, calcium? and olivine phenocrsyts.

INTERBED

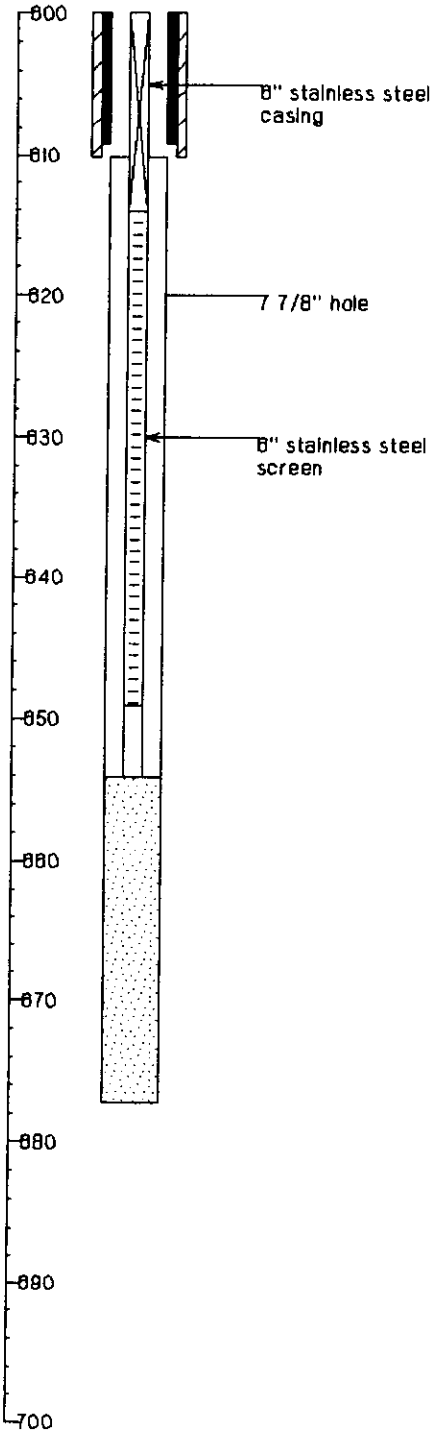
LOG OF WELL ANL-MON-A-11

Project Location EBR-II Leach Pit Characterization

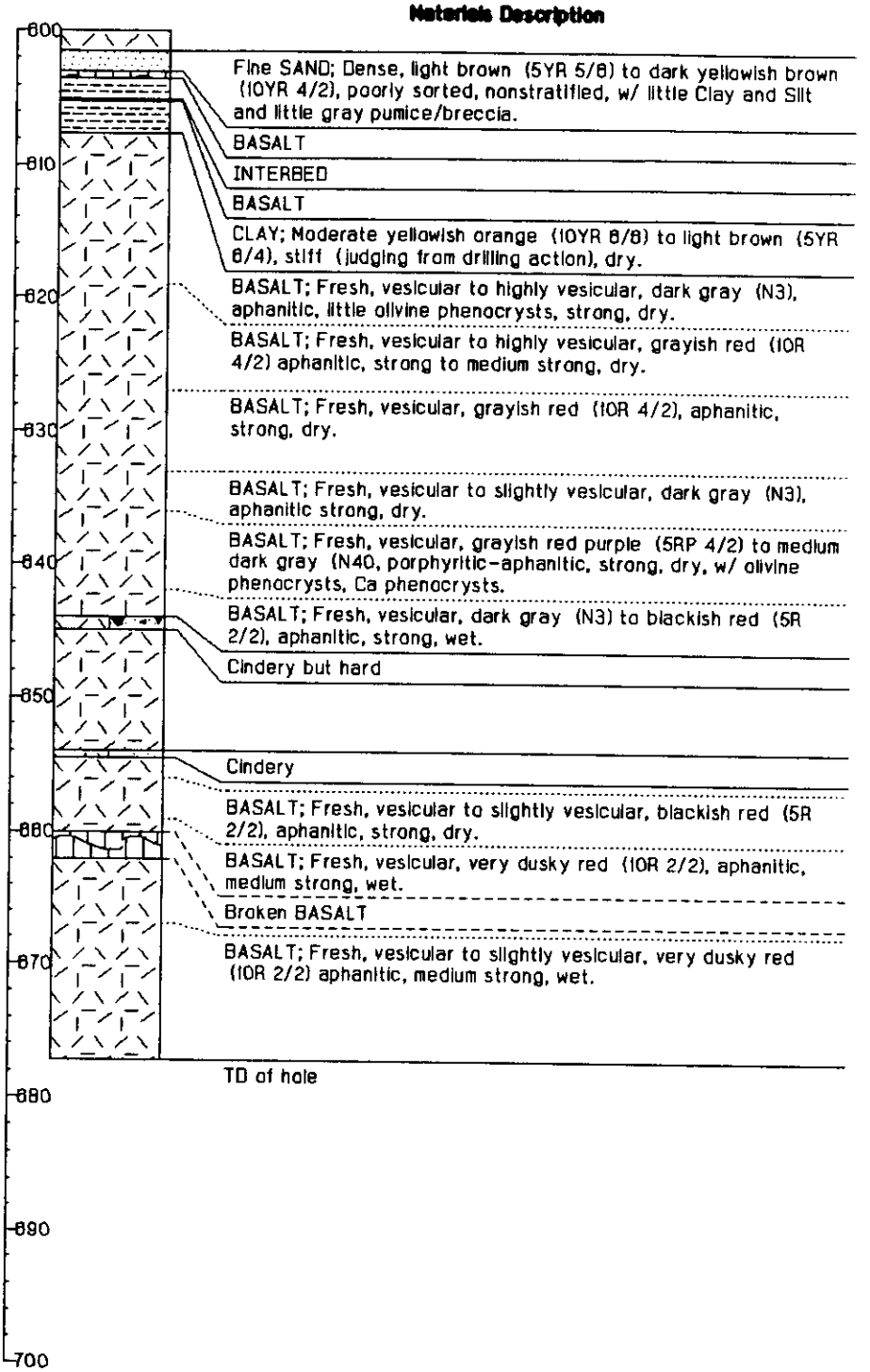
Driller SW of Leach pit

Total Depth Hawley Brothers

Well Description



Materials Description

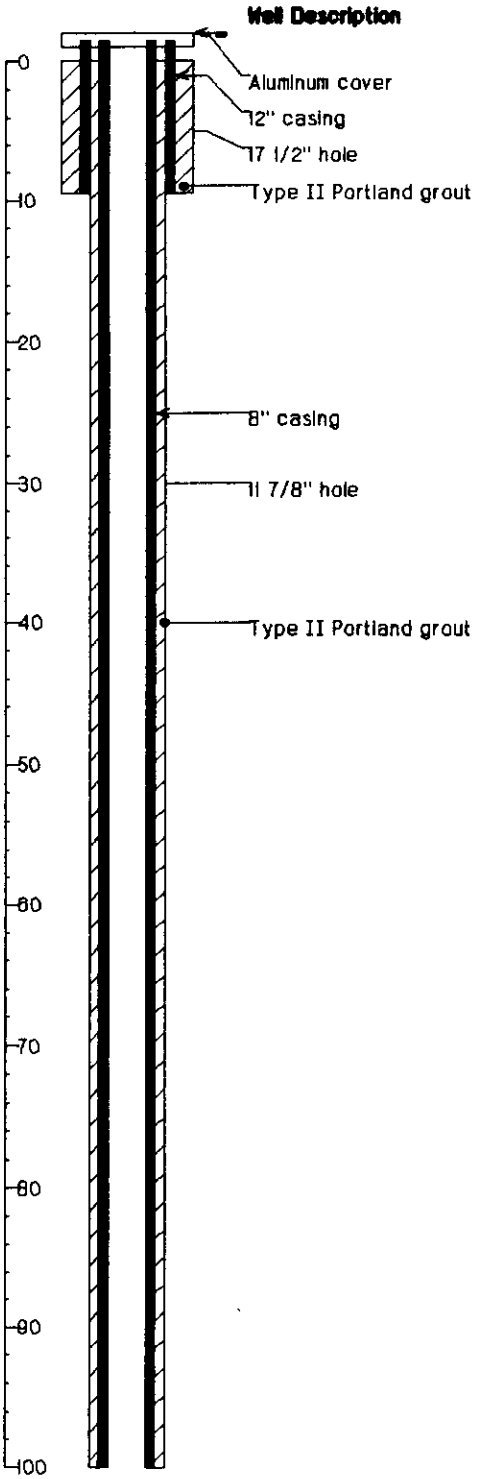


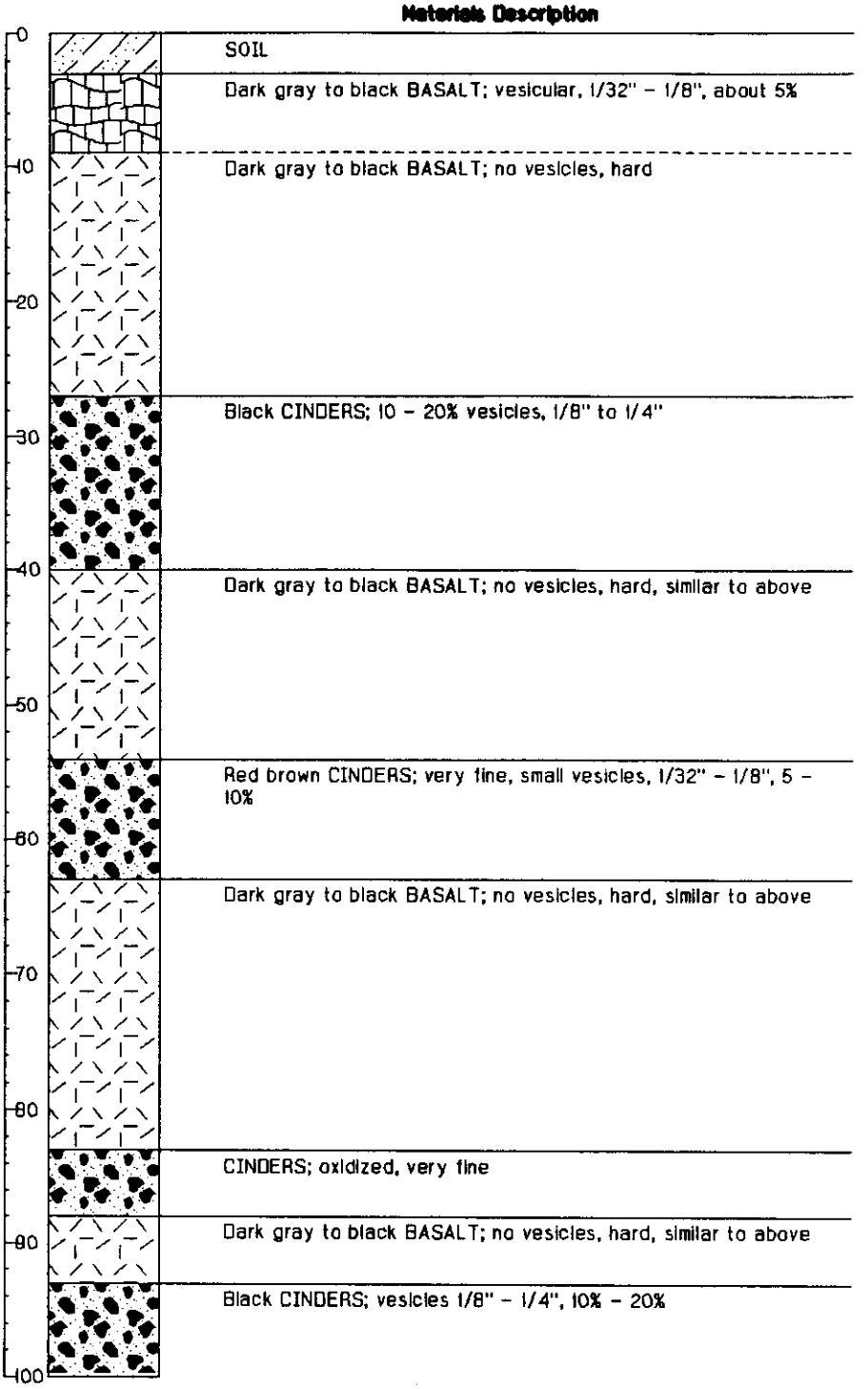
LOG OF WELL ANL-MON-A-12

Project Location: Up Gradient Well M-12

Driller: ANL-W site

Total Depth: P C Exploration





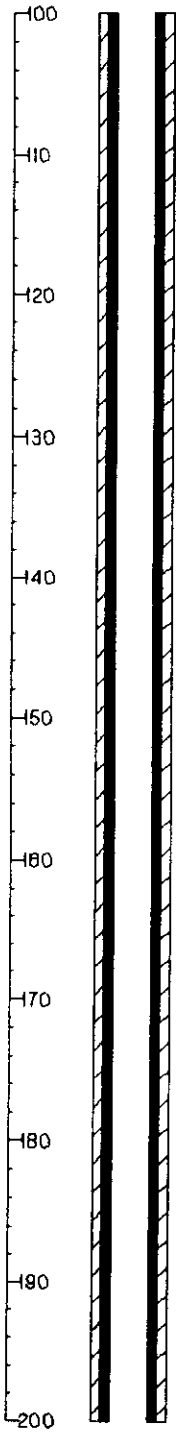
LOG OF WELL ANL-MON-A-12

Project Location Up Gradient Well M-12

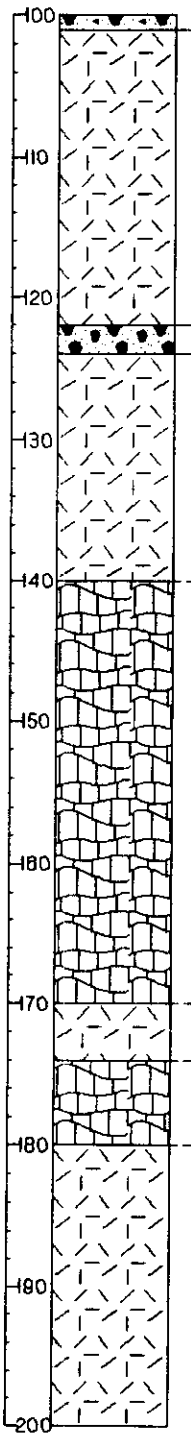
Driller ANL-W site

Total Depth P C Exploration

Well Description



Materials Description



Dark gray to black BASALT; no vesicles, hard, similar to above

Black CINDERS; 10-20% vesicles, 1/8" - 1/4"

Dark gray to black BASALT; no vesicles, hard, similar to above

Loss of Circulation Large porous CINDERS?

Dark gray to black BASALT; no vesicles, hard, similar to above

Loss of Circulation Large porous CINDERS?

Dark gray to black BASALT; no vesicles, hard, similar to above

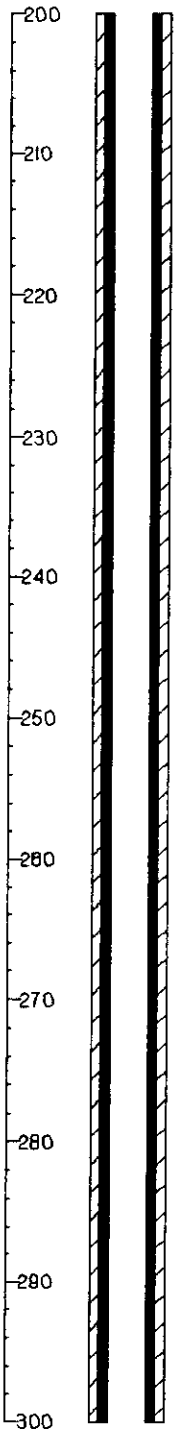
LOG OF WELL ANL-MON-A-12

Project Location Up Gradient Well M-12

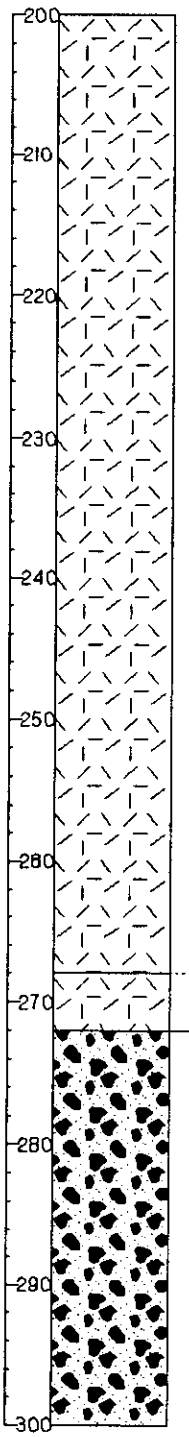
Driller ANL-W site

Total Depth P C Exploration

Well Description



Materials Description



Black BASALT; w/ Dark red oxidezed areas, inclusions 20-25% above 1/8", vesicles 5-10%, 1/8" - 3/8"

Medium Red brown CINDERS; 5-10% vesicles, 1/32" - 1/8"

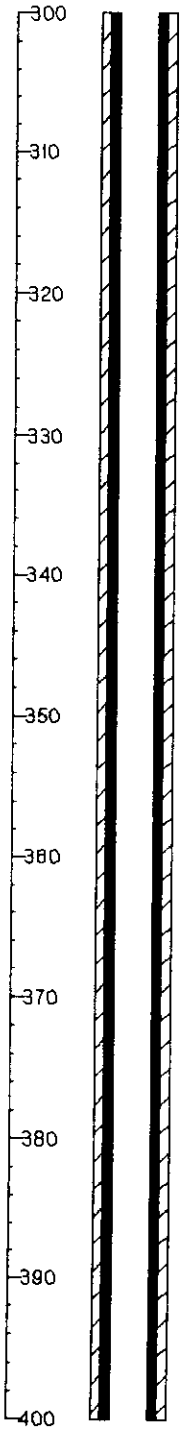
LOG OF WELL ANL-MON-A-12

Project Location Up Gradient Well M-12

Driller ANL-W site

Total Depth P C Exploration

Well Description



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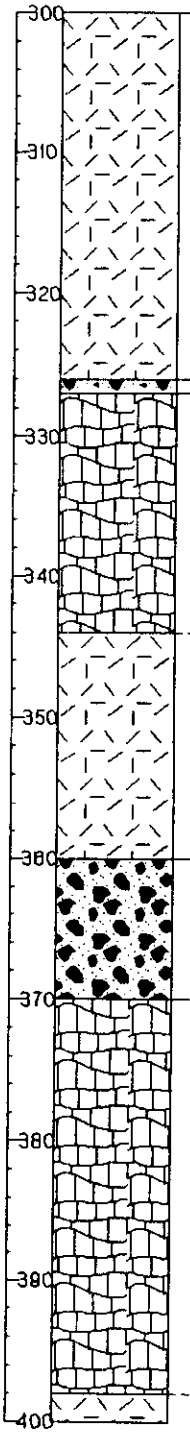


Black BASALT; < 1% vesicles, < 1/32", hard

Medium Red brown CINDERS 10-20% vesicles, 1/32" - 1/16"

Loss of Circulation More CINDERS?

Dark gray to Black BASALT; no vesicles, hard

Medium Red brown CINDERS; 10-20% vesicles, 1/32" - 1/8"

Black BASALT; < 1/32" vesicles, < 1%, soft

Dark gray to Black BASALT; no vesicles, hard

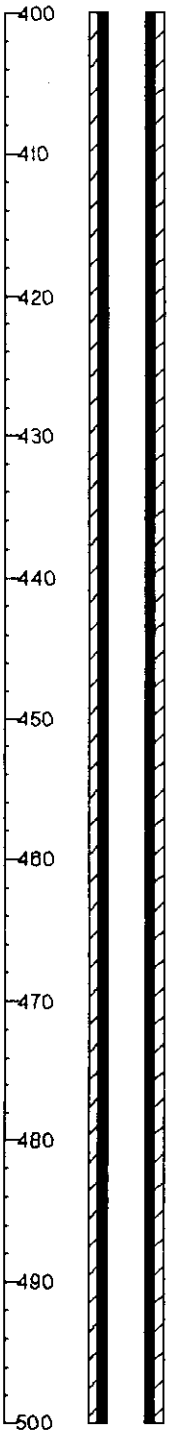
LOG OF WELL ANL-MON-A-12

Project Location Up Gradient Well M-12

Driller ANL-W site

Total Depth P C Exploration

Well Description



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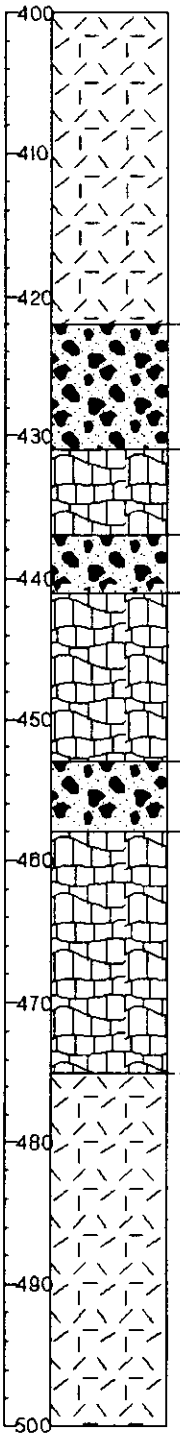


Dark red CINDERS; < 1/32"- 1/4", 10-20% vesicles

Black BASALT; 1/32" - 1/16" vesicles, < 1%

Dark red CINDERS; similar to above

Black BASALT; similar to above

Dark red CINDERS; similar to above, w/ Ltight tan oxide coating

Black BASALT; similar to above

Dark gray to black BASALT; no vesicles, hard

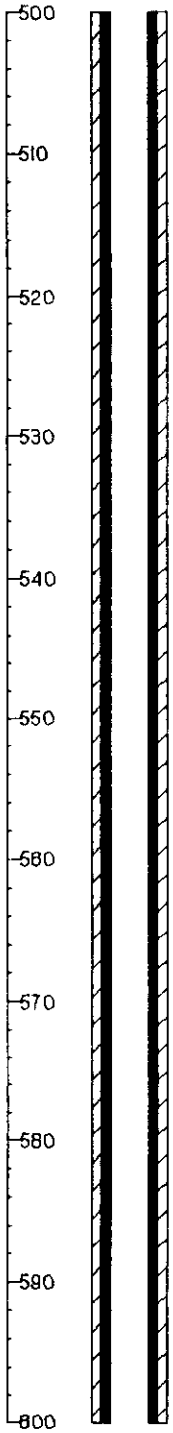
LOG OF WELL ANL-MON-A-12

Project Location Up Gradient Well M-12

Driller ANL-W site

Total Depth P C Exploration

Well Description



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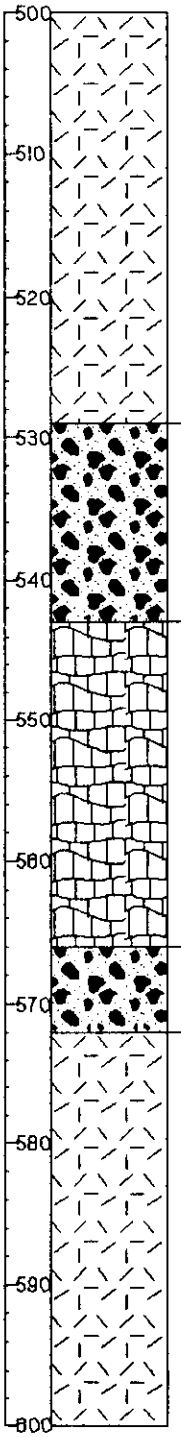


Dark red CINDERS; < 1/32" - 1/8", < 5% vesicles

Loss of Circulation No samples

Very fine Dark gray SAND; resembles hard BASALT - no chips to identify

Dark gray to black BASALT; no vesicles, hard

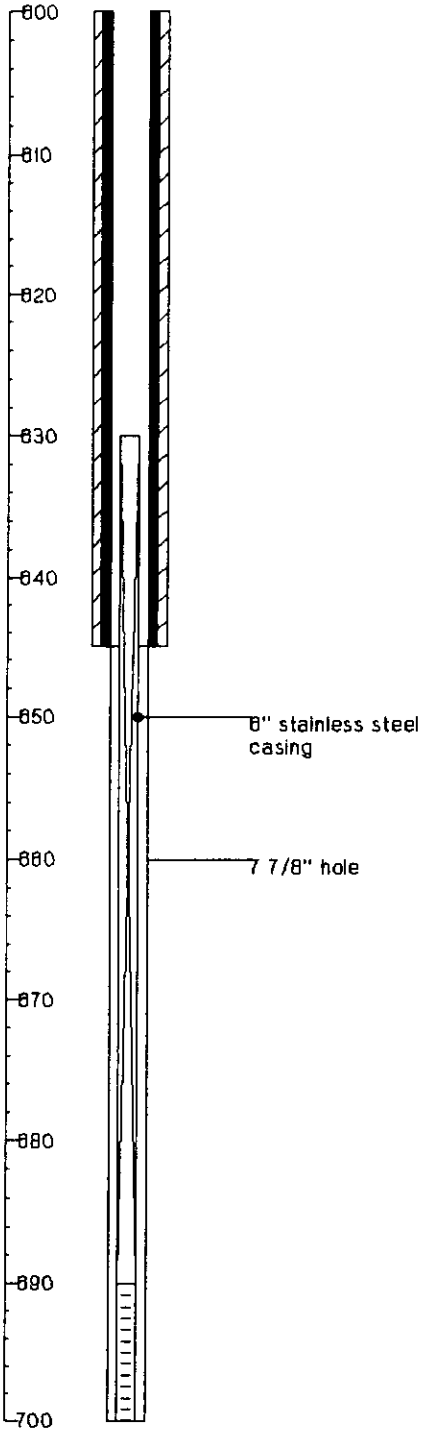
LOG OF WELL ANL-MON-A-12

Project Location: Up Gradient Well M-12

Driller: ANL-W site

Total Depth: P C Exploration

Well Description



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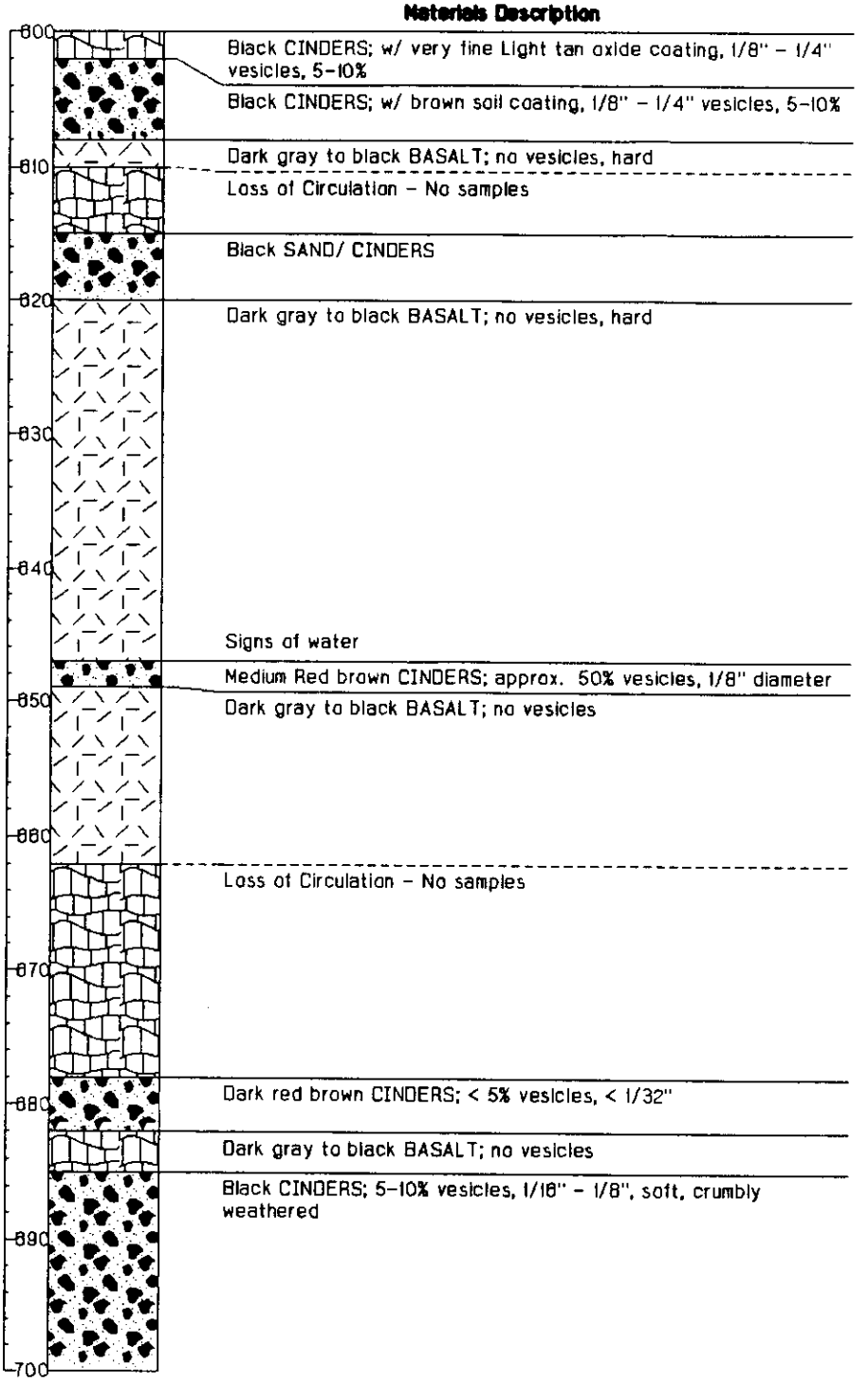


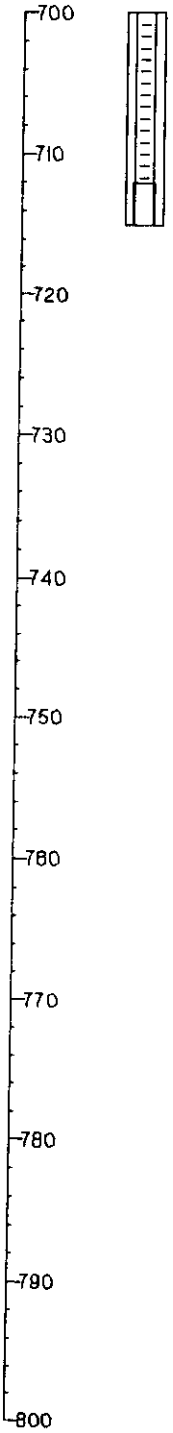
LOG OF WELL ANL-MON-A-12

Project Location Up Gradient Well M-12

Driller ANL-W site

Total Depth P C Exploration

Well Description



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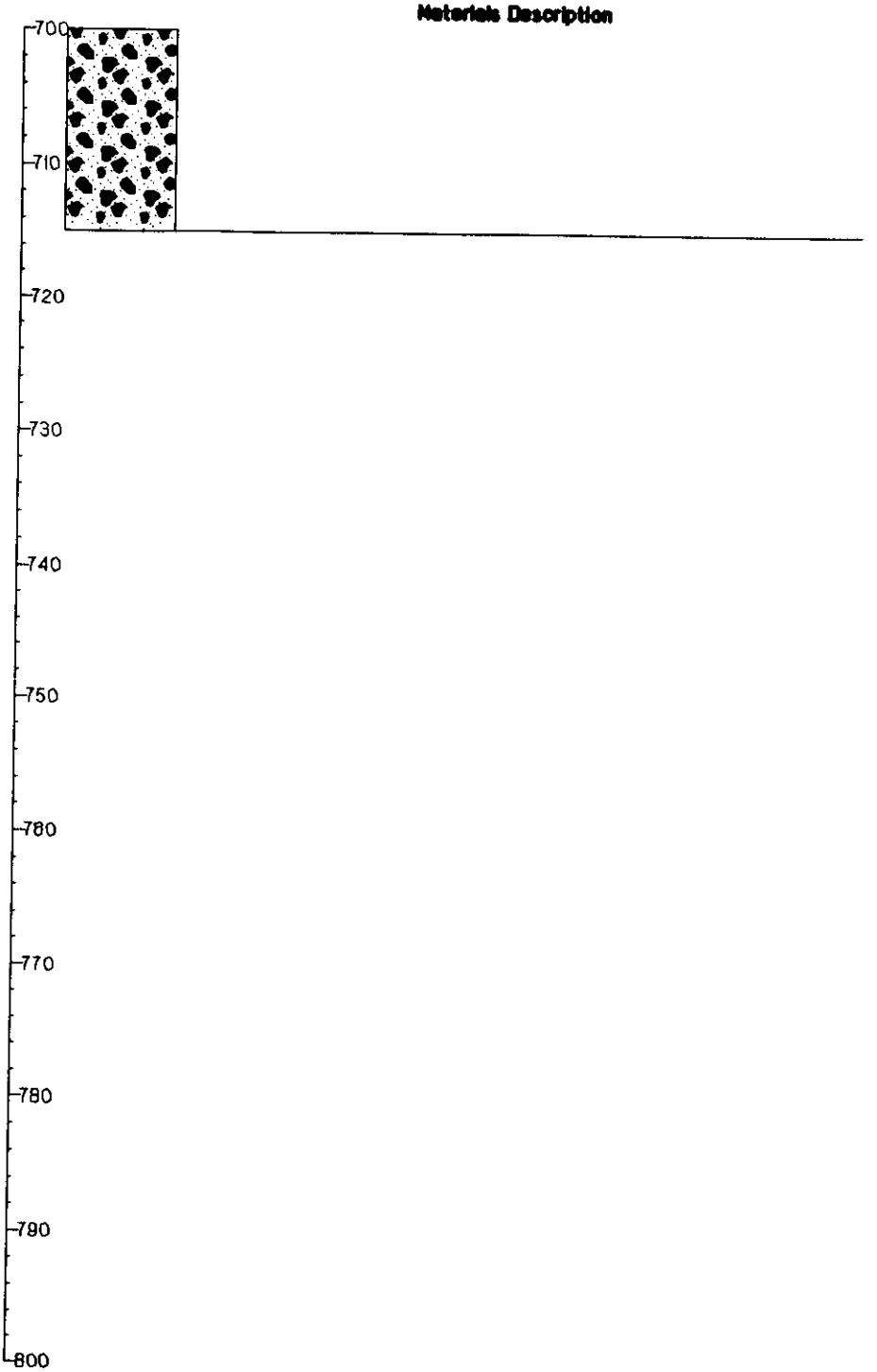
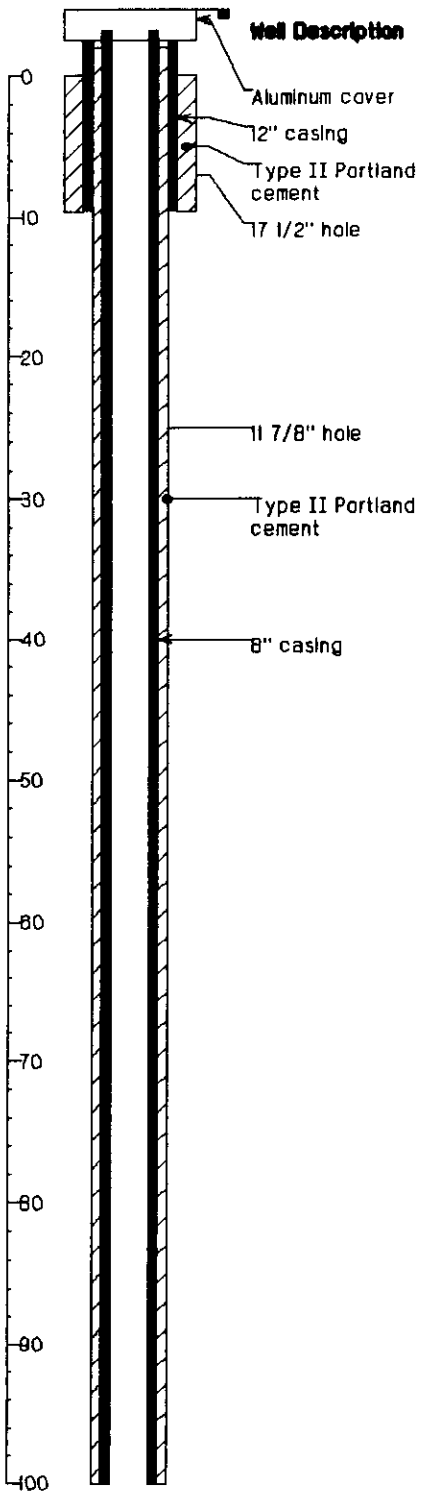


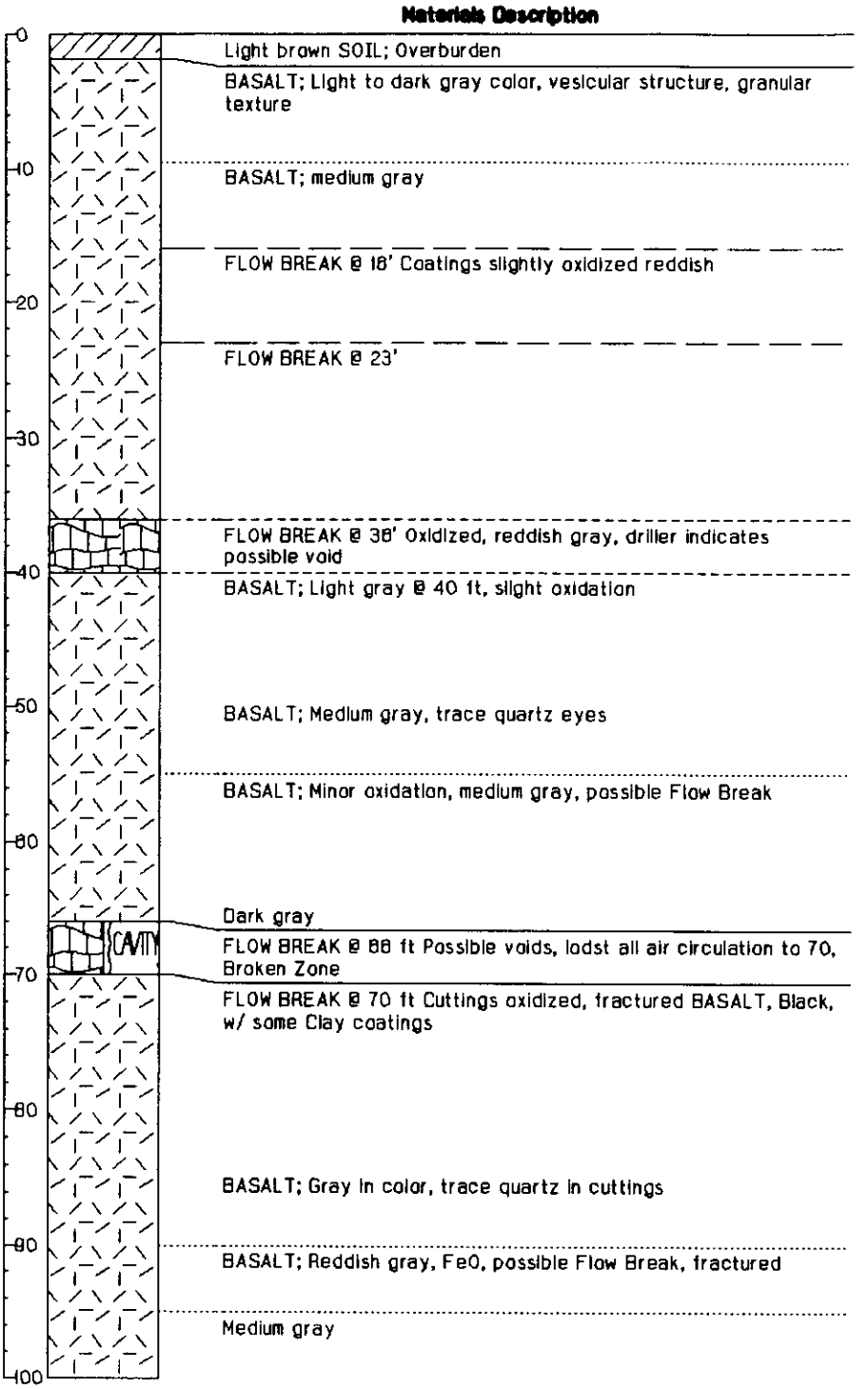
LOG OF WELL ANL-MON-A-13

Project Location INEL Groundwater Monitoring Plan well

Driller SW of IWP

Total Depth PC Exploration





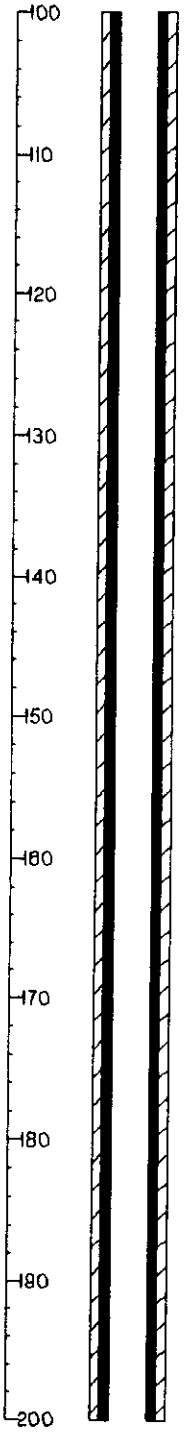
LOG OF WELL ANL-MON-A-13

Project Location INEL Groundwater Monitoring Plan well

Driller SW of IWP

Total Depth PC Exploration

Well Description



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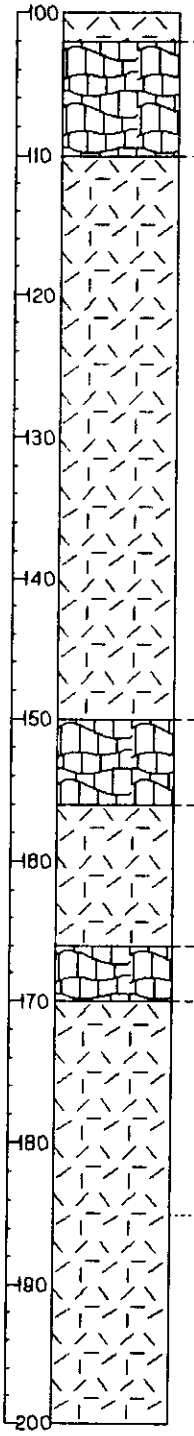


FLOW BREAK w/ open areas, voids, blocky drilling, more than one flow interval possible within this interval.

Medium gray

BASALT; Gray, competent rock w/ few substantive fractures

BASALT; Medium gray, some fractures mostly competent rock

BASALT; Gray, voids, lost circulation

BASALT; reddish gray, oxidized, possible Flow Break, voids

BASALT; Gray, minor oxidation, Rubble Zone

BASALT; Black to dark gray, oxidized

BASALT; Medium gray, competent rock w/ few substantial fractures, trace quartz eyes

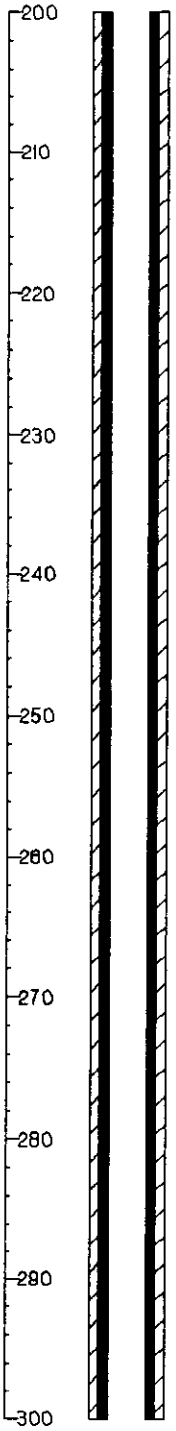
LOG OF WELL ANL-MON-A-13

Project Location INEL Groundwater Monitoring Plan well

Driller SW of IWP

Total Depth PC Exploration

Well Description



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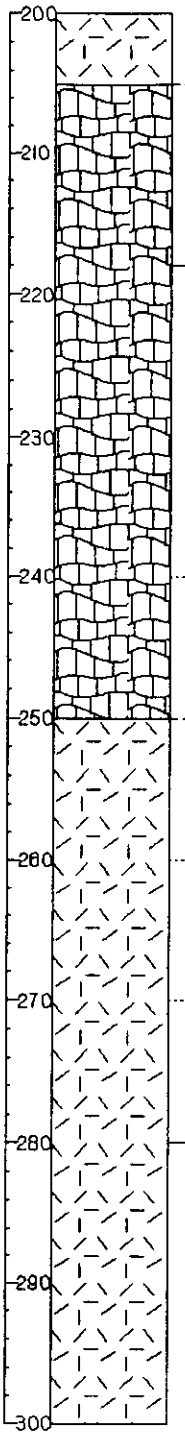


FLOW BREAK @ 218

Fractured BASALT

BASALT; Light to dark reddish gray, minor oxidation, Rubble zone

Gray, more competent

BASALT; Black, slight oxidation, possible Flow Break

Light gray

Medium gray

FLOW BREAK/ Substantial Fracture; medium gray, slight oxidation

Light to dark gray

BASALT; medium gray, competent rock to 310

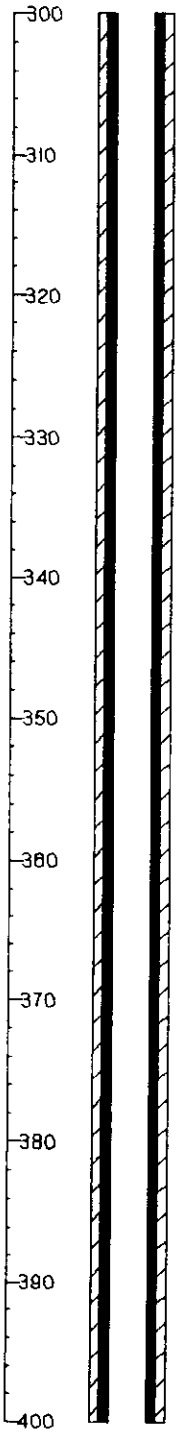
LOG OF WELL ANL-MON-A-13

Project Location INEL Groundwater Monitoring Plan well

Driller SW of IWP

Total Depth PC Exploration

Well Description



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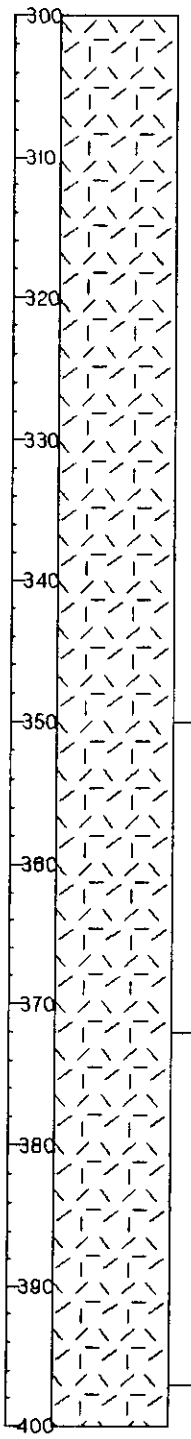


BASALT; Dark gray to black, trace FeO

BASALT; Light to dark gray, fractures altered w/ Clay adhering to cuttings (Clay/ Light brown)

BASALT; Dark gray, competent rock to 350

Light to medium gray

FLOW BREAK BASALT, Dark gray, slight oxidation

Light gray, Clay on fractures

Light gray

Minor Clay on cuttings, probably on fracture

medium gray

FLOW BREAK @ 372 BASALT, oxidized, vesicular

More Clay adhered to cuttings indicates fractures

Light gray to Medium gray

FLOW BREAK @ 397 BASALT, dark gray to brick red, FeO

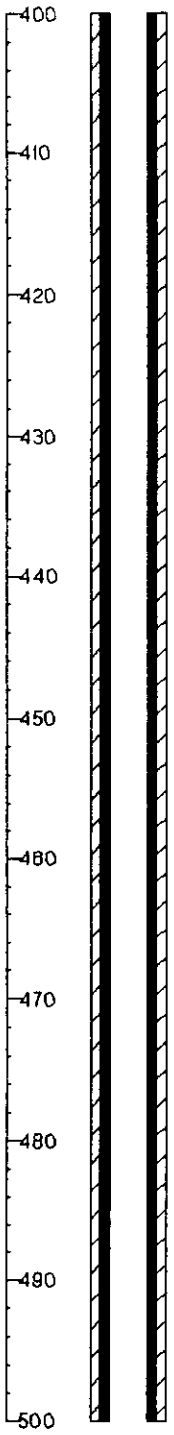
LOG OF WELL ANL-MON-A-13

Project Location INEL Groundwater Monitoring Plan well

Driller SW of IWP

Total Depth PC Exploration

Well Description



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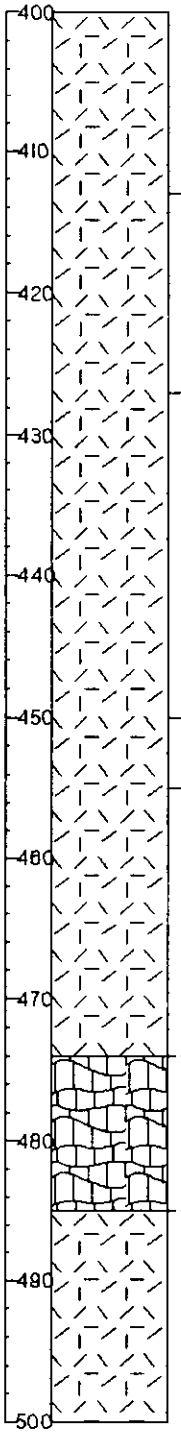


Light to medium gray

FLOW BREAK @ 413 BASALT, light gray, trace to minor oxidation

Dark gray, competent rock

Possible FLOW BREAK, getting light gray CLAY in cuttings
probable Clay interbed

Light to medulm gray, trace quartz eyes

Possible FLOW BREAK trace oxidation

Possible FLOW BREAK Light gray CLAY in cuttings

Light to medium gray BASALT

FLOW BREAK @ 474 BASALT, light to dark gray, oxidation, trace quartz eyes

Rubble Zone

FLOW BREAK @ 485 Cuttings moderately oxidized, minor quartz eyes.

BASALT,vesicular, light gray

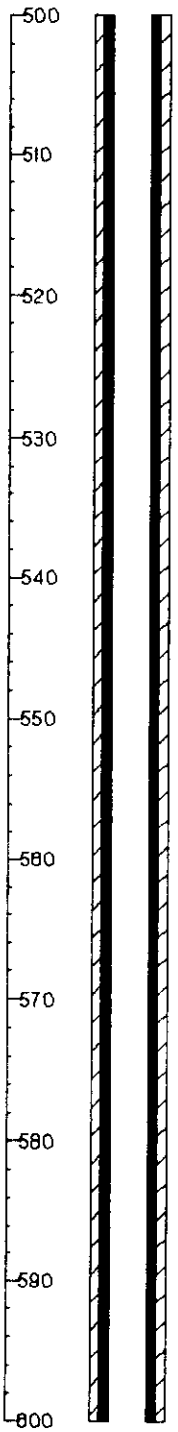
LOG OF WELL ANL-MON-A-13

Project Location INEL Groundwater Monitoring Plan well

Driller SW of IWP

Total Depth PC Exploration

Well Description



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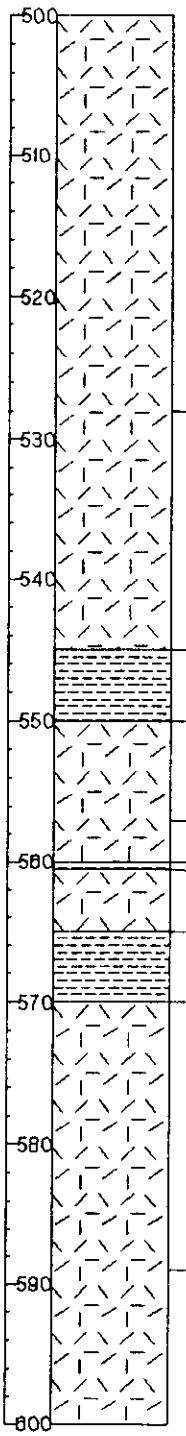


Minor quartz eyes

Medium gray, competent Basalt w/ few fractures taking air

FLOW BREAK @ 528 BASALT, oxidized, reddish gray in color Lost circulation - No samples till 545; Dust red in color

Dust brown in color w/ brown CLAY and Black BASALT, very little sample

BASALT; Medium gray, trace quartz

FLOW BREAK @ 557 BASALT, dark gray, oxidized

CLAY; Black to brown

FLOW BREAK @ 565 CLAY, brown to orange brown

FLOW BREAK @ 570 BASALT, medium gray, oxidized

Medium gray

FLOW BREAK @ 589 BASALT, medium gray, moderately oxidized

Light gray

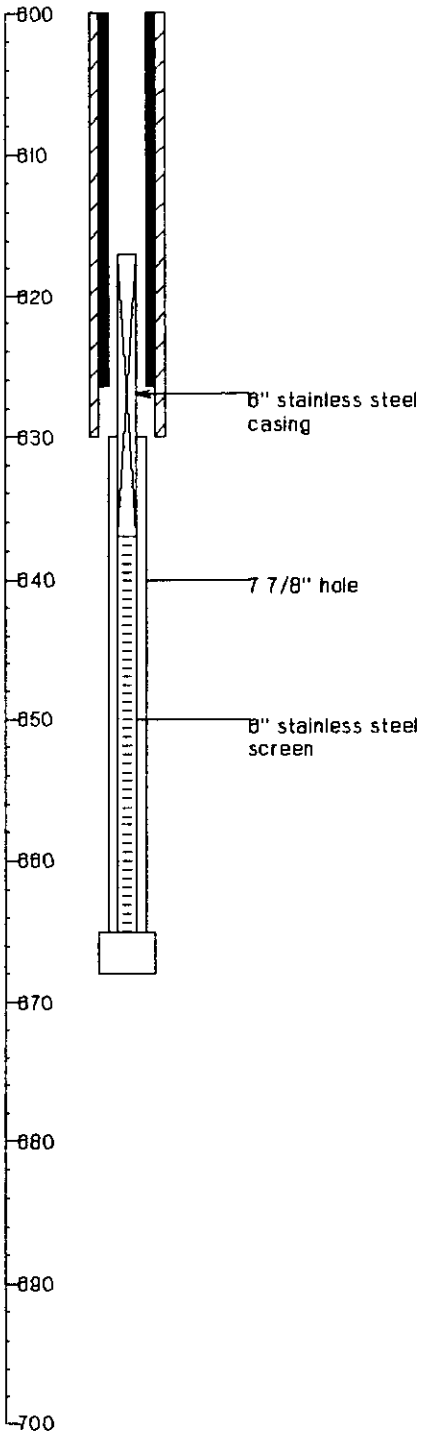
LOG OF WELL ANL-MON-A-13

Project Location INEL Groundwater Monitoring Plan well

Driller SW of IWP

Total Depth PC Exploration

Well Description



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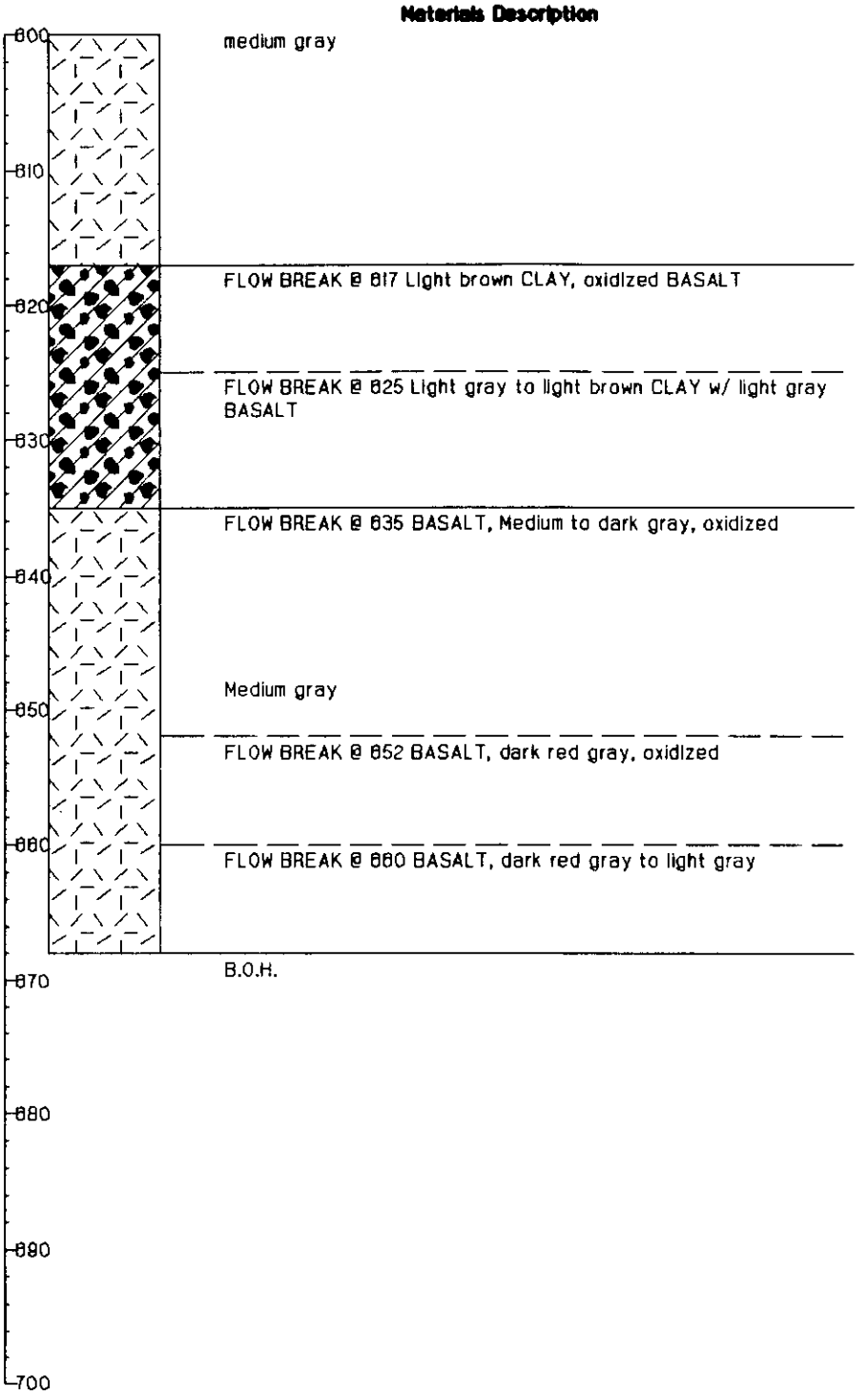


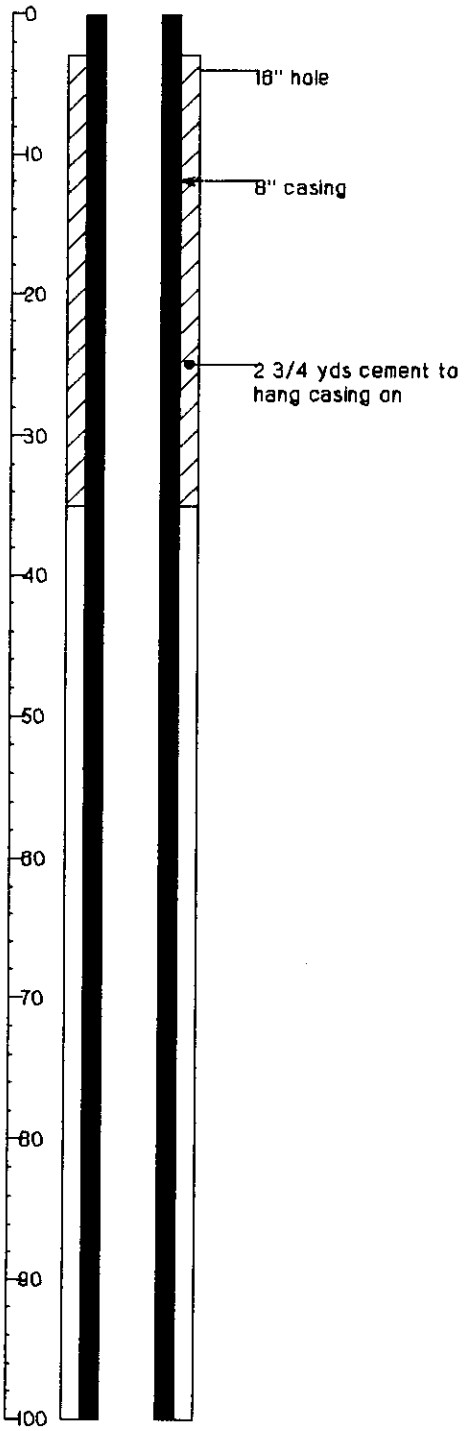
LOG OF WELL Site 16

Project Location EBR-II Construction

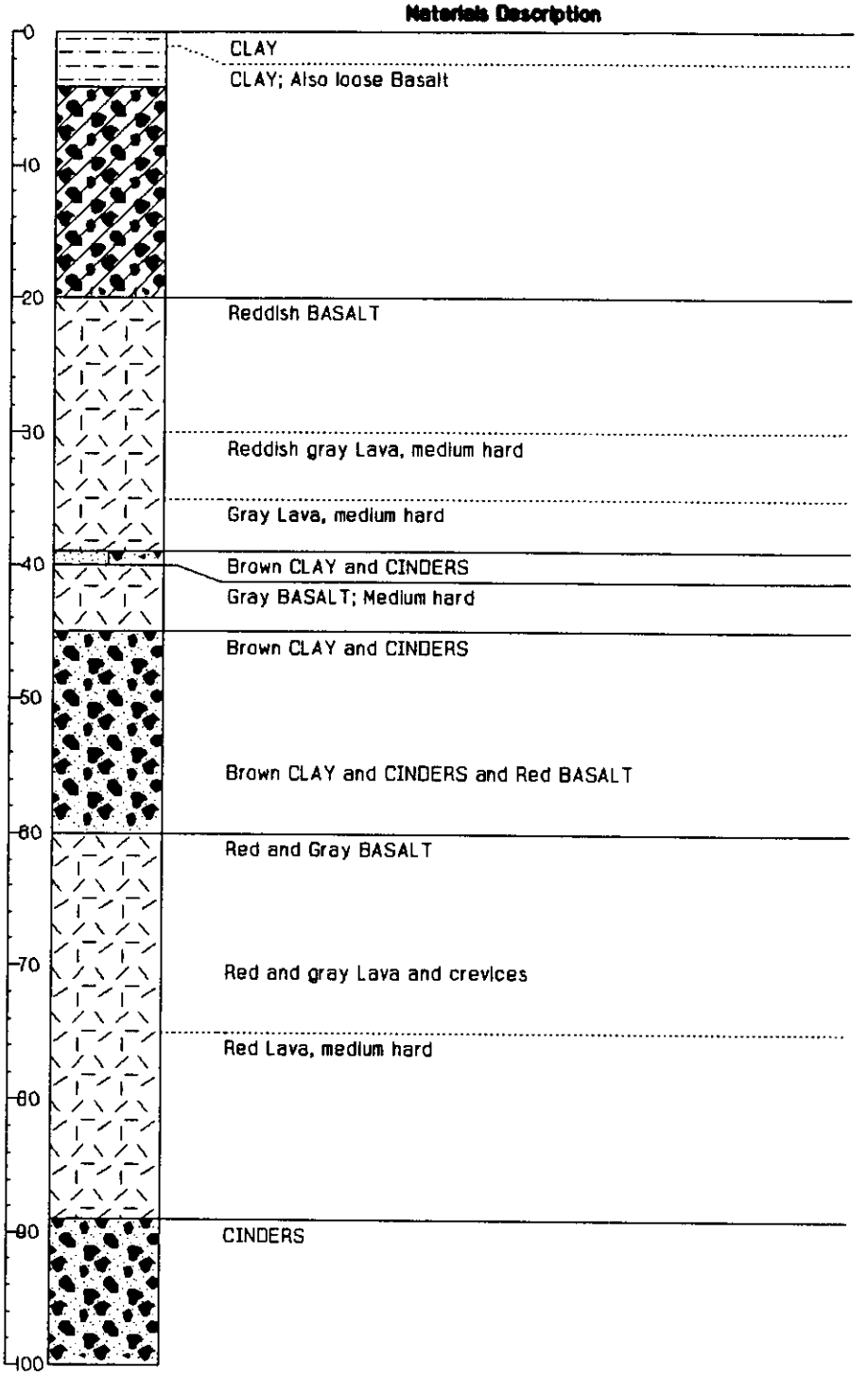
Driller East of Building 780

Total Depth

Well Description



Materials Description



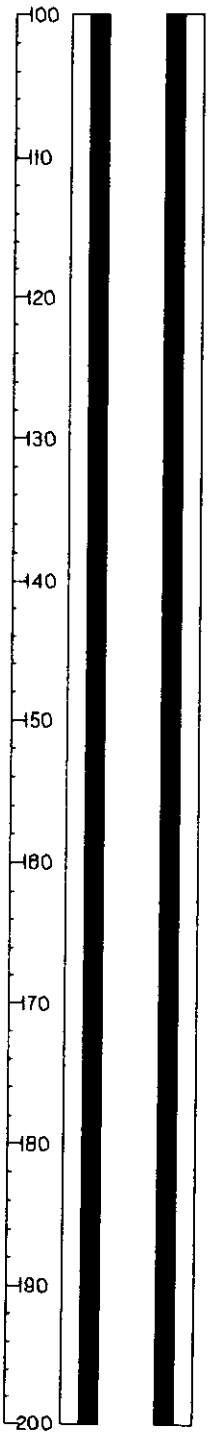
LOG OF WELL Site 16

Project Location EBR-II Construction

Driller East of Building 780

Total Depth

Well Description



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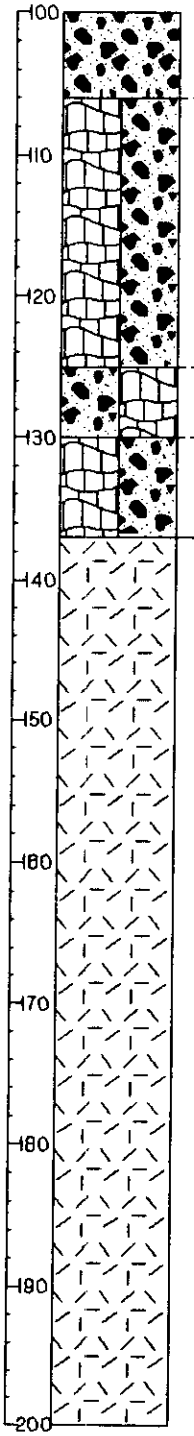


Loose rock and CINDERS

CINDERS and red BASALT

Red BASALT and CINDERS

Gray BASALT, Hard

Hard gray Lava and crevices

Hard gray Lava

Hard gray Lava and crevices

Medium hard gray Lava and crevices

Hard gray Lava and crevices

Hard gray Lava

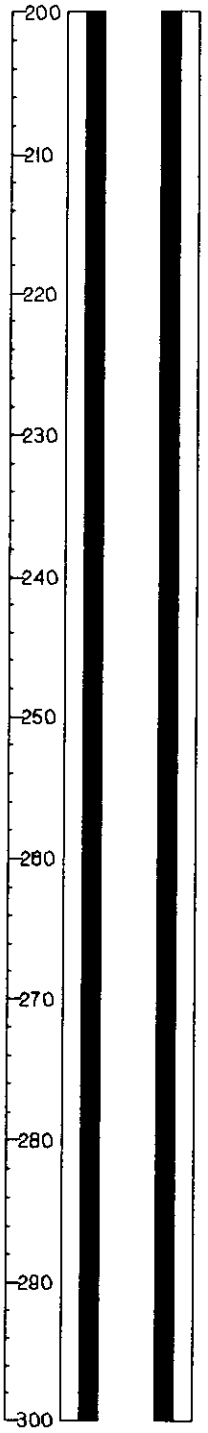
LOG OF WELL Site 16

Project Location EBR-II Construction

Driller East of Building 790

Total Depth

Well Description



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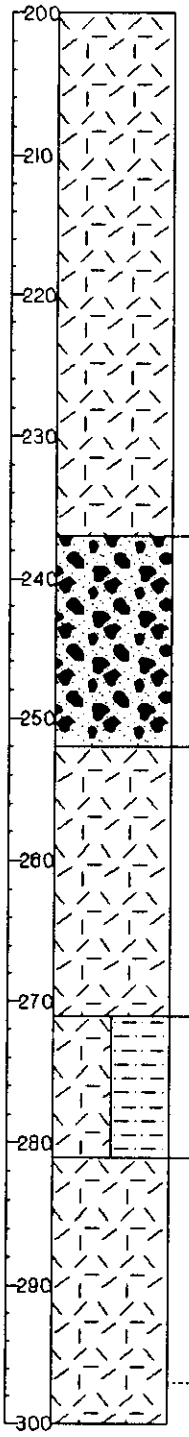


Red BASALT and CINDERS

Red BASALT

Red porous Lava

Red Lava, reddish brown Clay in crevices

Red Lava with brown Clay

Gray BASALT

Gray Lava, medium soft

Reddish gray Lava

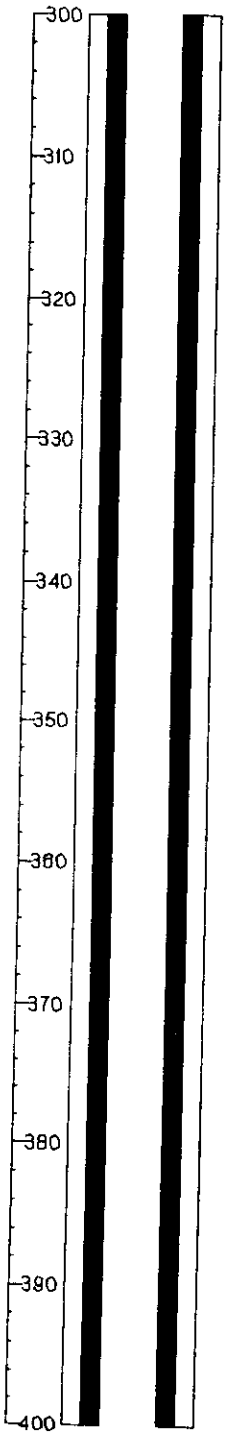
LOG OF WELL Site 16

Project Location EBR-II Construction

Driller East of Building 790

Total Depth

Well Description



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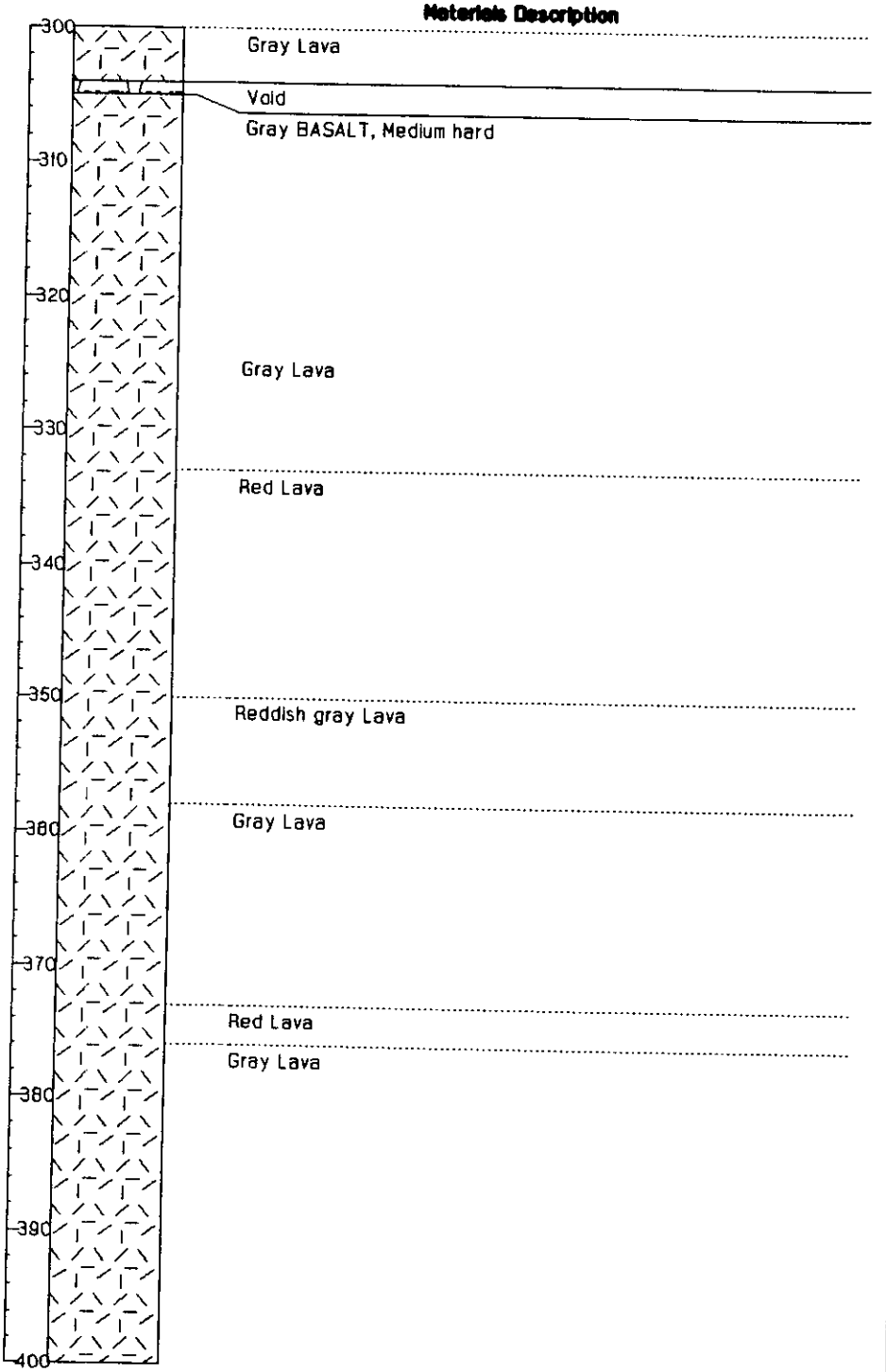


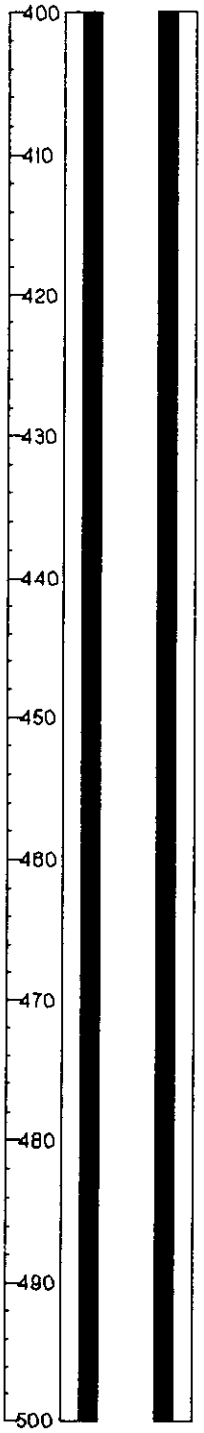
LOG OF WELL Site 16

Project Location EBR-II Construction

Driller East of Building 780

Total Depth

Well Description



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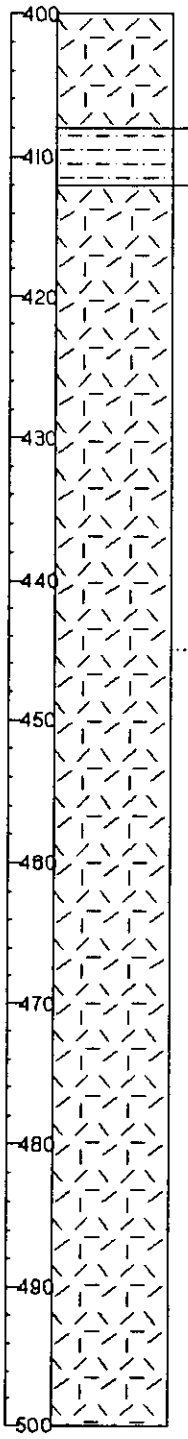


Brown and Tan CLAY

Brown CLAY

Gray BASALT, Soft

Gray Lava, medium hard (reddish)

Red Lava, medium hard

Red Lava

Hard red Lava

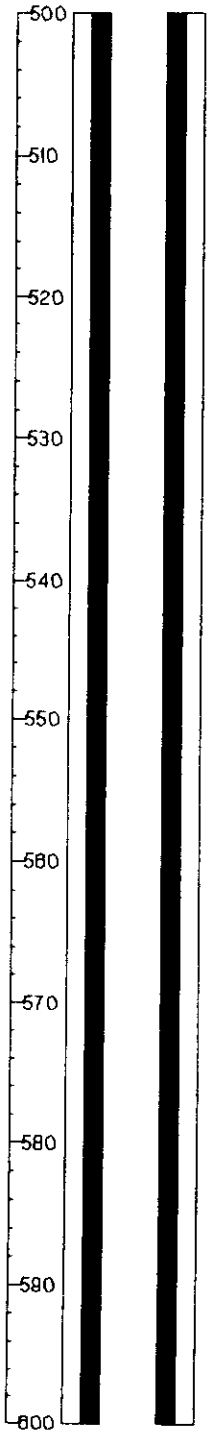
LOG OF WELL Site 16

Project Location EBR-II Construction

Driller East of Building 790

Total Depth

Well Description



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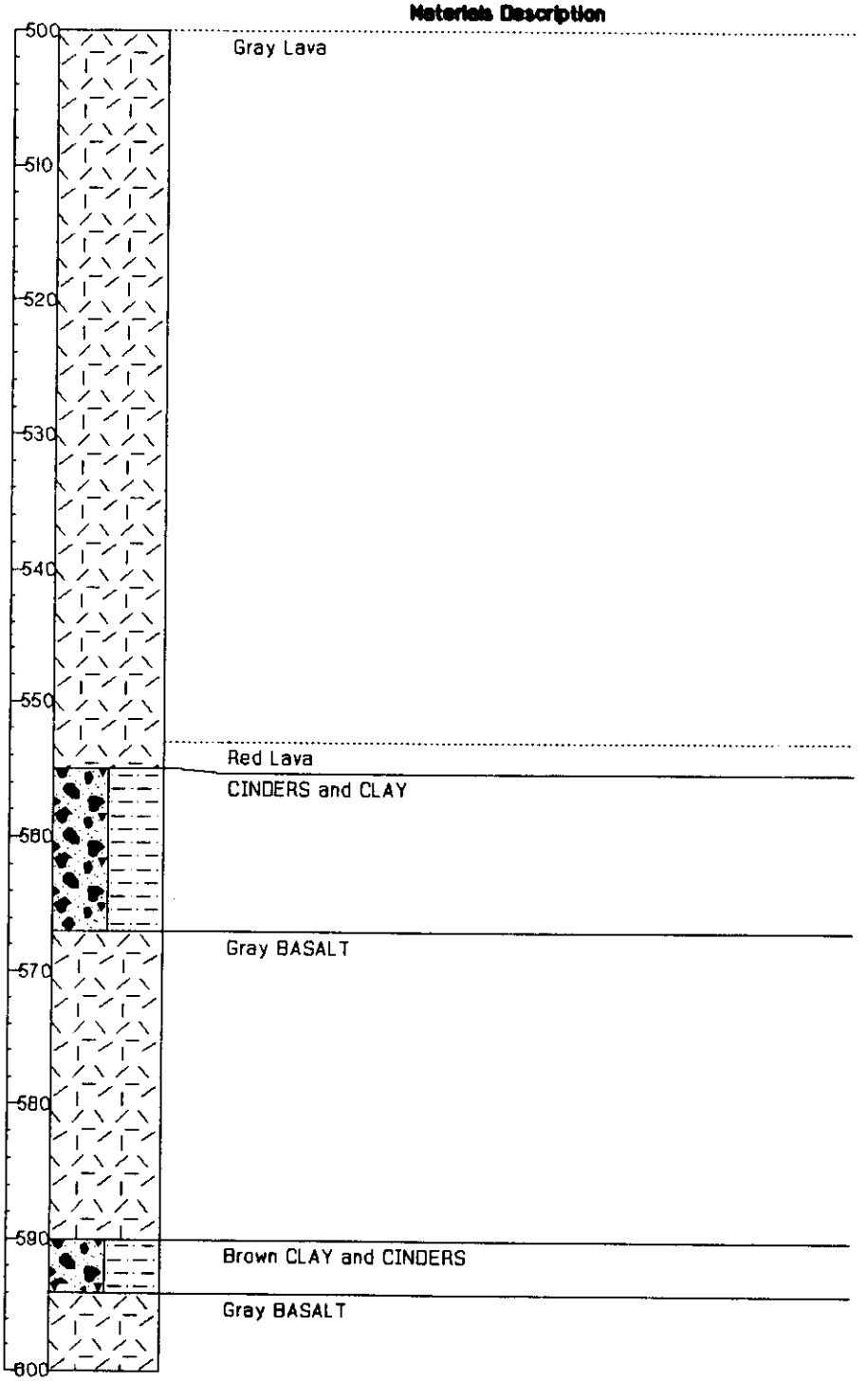


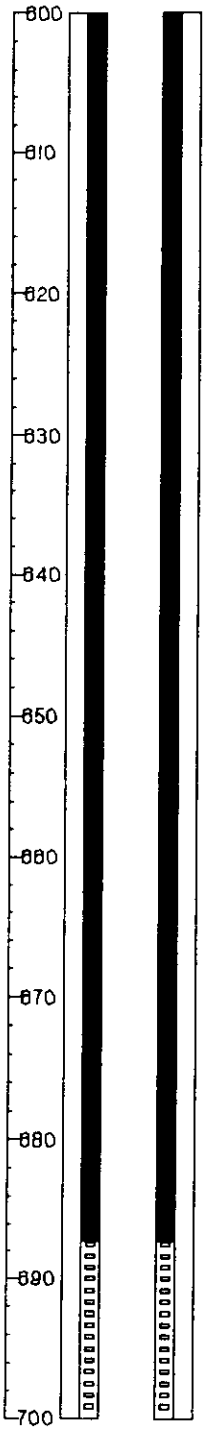
LOG OF WELL Site 16

Project Location EBR-II Construction

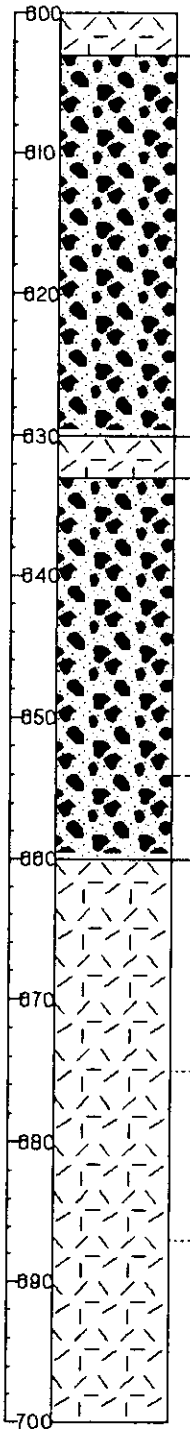
Driller East of Building 790

Total Depth

Well Description



Materials Description



CINDERS

Loose rock and Cinders

Red BASALT

Red CINDERS and Water

Red and Black Cinders

Gray BASALT

Reddish gray Lava

Gray Lava

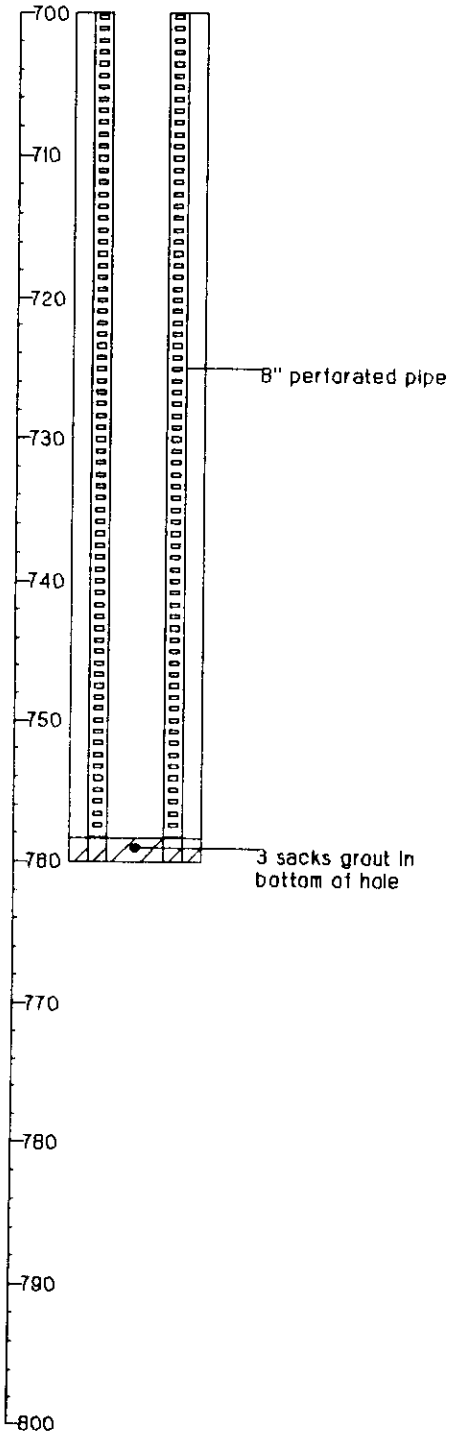
LOG OF WELL Site 16

Project Location EBR-II Construction

Driller East of Building 790

Total Depth

Well Description



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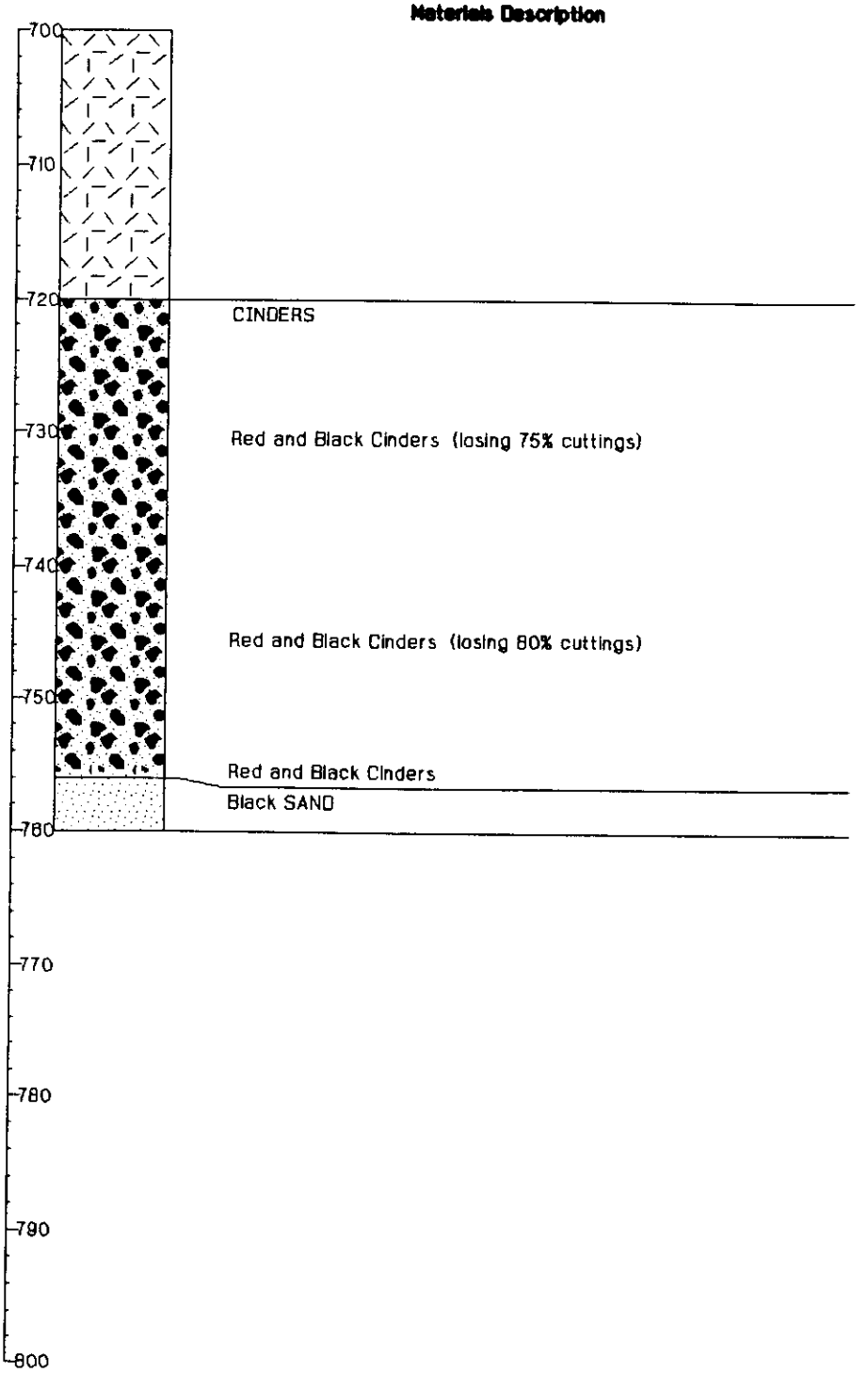
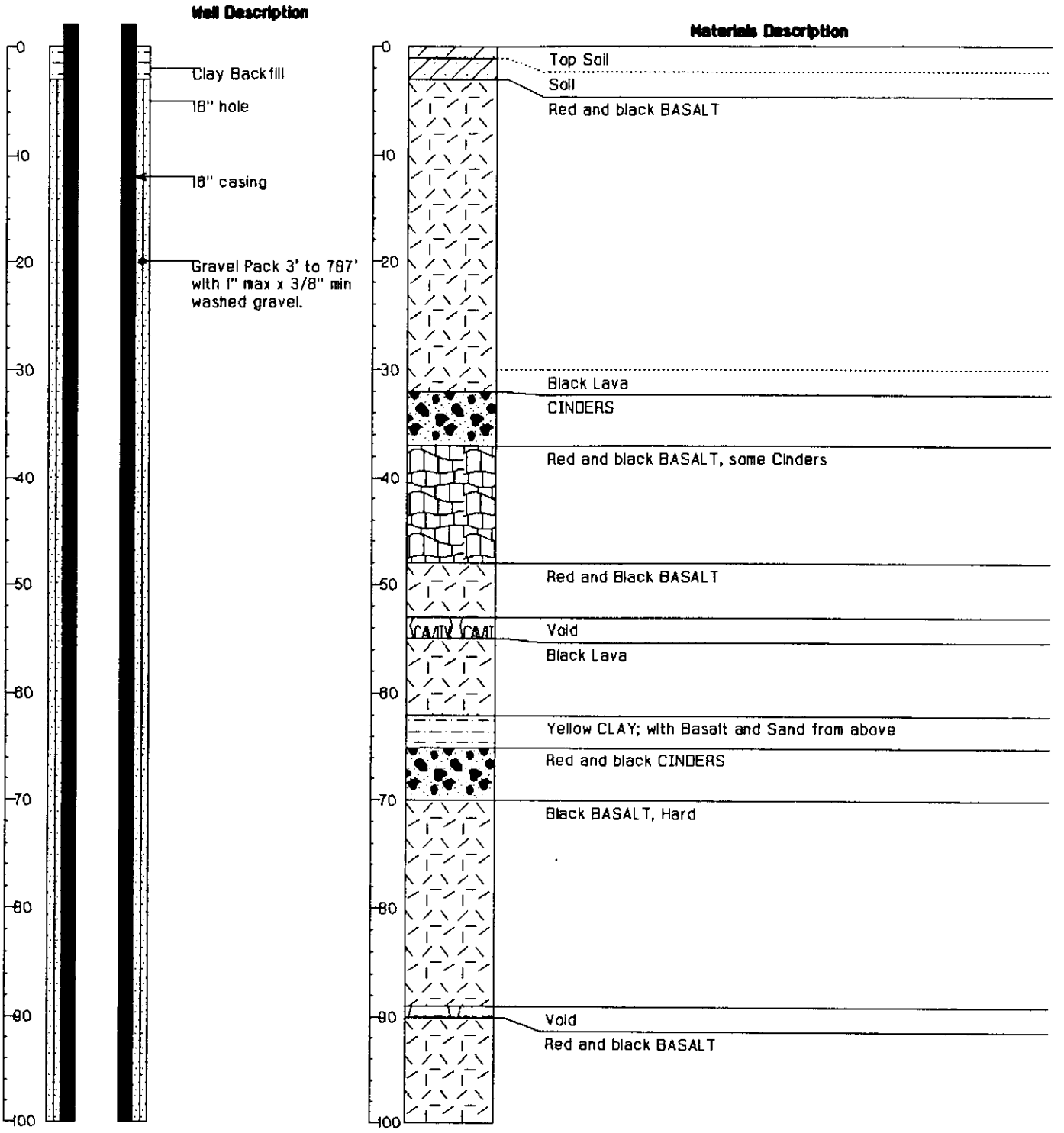


LOG OF WELL Arbor Test

Project Location: Arbor Test Facility Presiting Investigation

Driller: South of SE corner of ANL-W

Total Depth: Cushman and Johnson



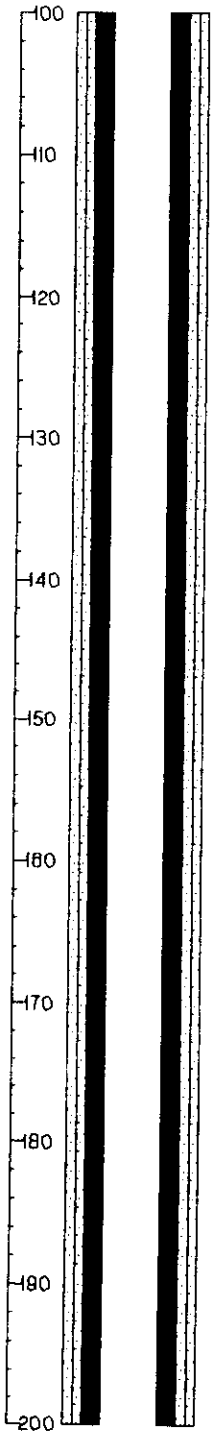
LOG OF WELL Arbor Test

Project Location Arbor Test Facilly Presiting Investigation

Driller South of SE corner of ANL-W

Total Depth Cushman and Johnson

Well Description



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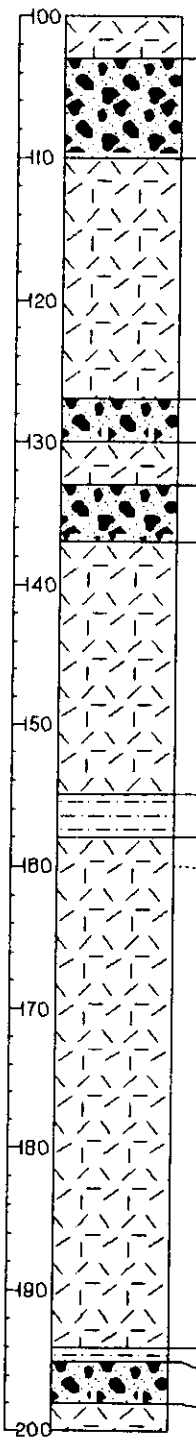


Red and black CINDERS

Red and black BASALT

Red and black Lava, Hard

Red and black CINDERS

Red and black BASALT

Red and black CINDERS

Red and black BASALT

Brown CLAY

Black BASALT

Red and black Lava

Red and black Lava, Soft

Red and Black Lava

with some gray CLAY

Red and Black CINDERS

Red and black Lava

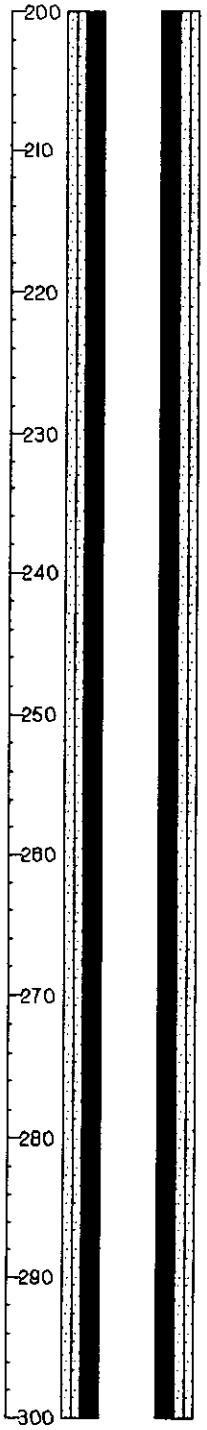
LOG OF WELL Arbor Test

Project Location: Arbor Test Facility Presiting Investigation

Driller: South of SE corner of ANL-W

Total Depth: Cushman and Johnson

Well Description



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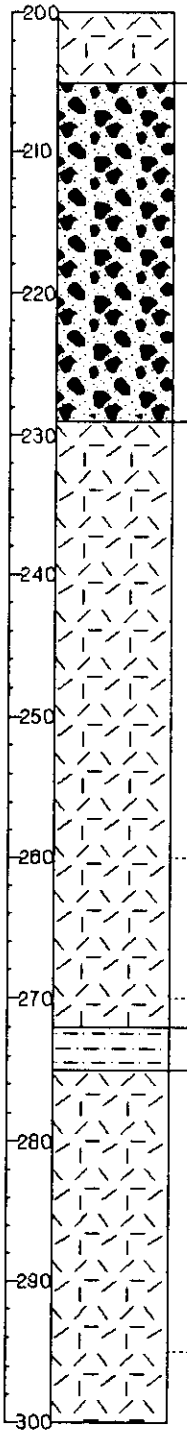


Red and black CINDERS

Red and Black BASALT

Red and Black Lava, hard

Blue Basalt

Blue also gray Lava

Black Lava

Red Clay; with some red Basalt

Red and black BASALT

Black Lava

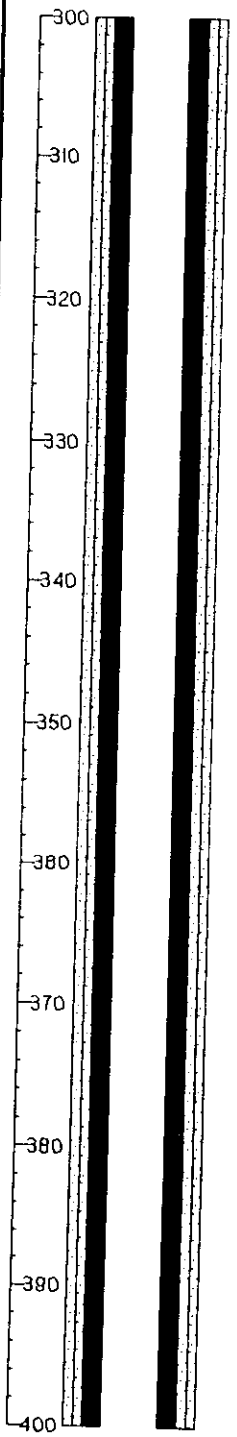
Project Location Arbor Test Facility Presiting Investigation

Driller South of SE corner of ANL-W

Total Depth Cushman and Johnson

LOG OF WELL Arbor Test

Well Description



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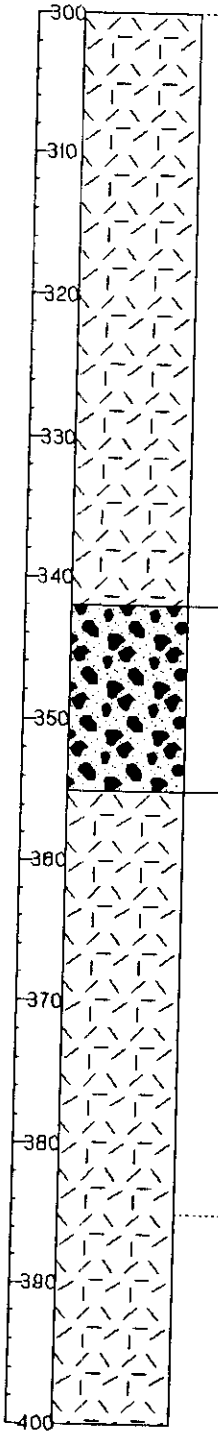


Red and Black Lava

Red and black CINDERS

Red and black Cinders with small black Basal· ·dges

Red and Black BASALT

Black Lava

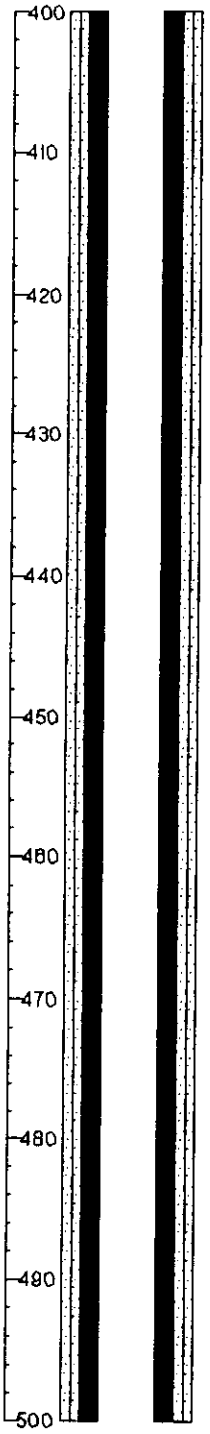
LOG OF WELL Arbor Test

Project Location: Arbor Test Facility Presiting Investigation

Driller: South of SE corner of ANL-W

Total Depth: Cushman and Johnson

Well Description



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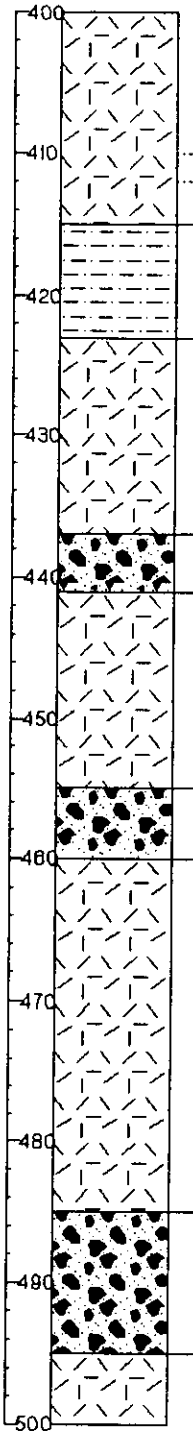


Gray Lava, hard

Black Lava

Rust CLAY

Red and black BASALT

Red and black CINDERS

Red and Black BASALT

Red and black CINDERS; with streak of black Basalt

Black BASALT

Black Lava, some red

Red and black CINDERS

Red and Black BASALT

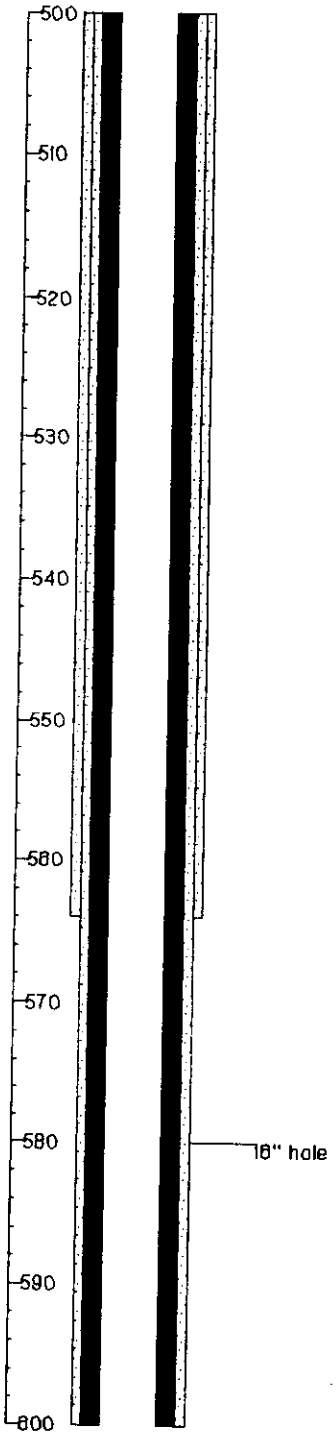
LOG OF WELL Arbor Test

Project Location Arbor Test Facility Presiting Investigation

Driller South of SE corner of ANL-W

Total Depth Cushman and Johnson

Well Description



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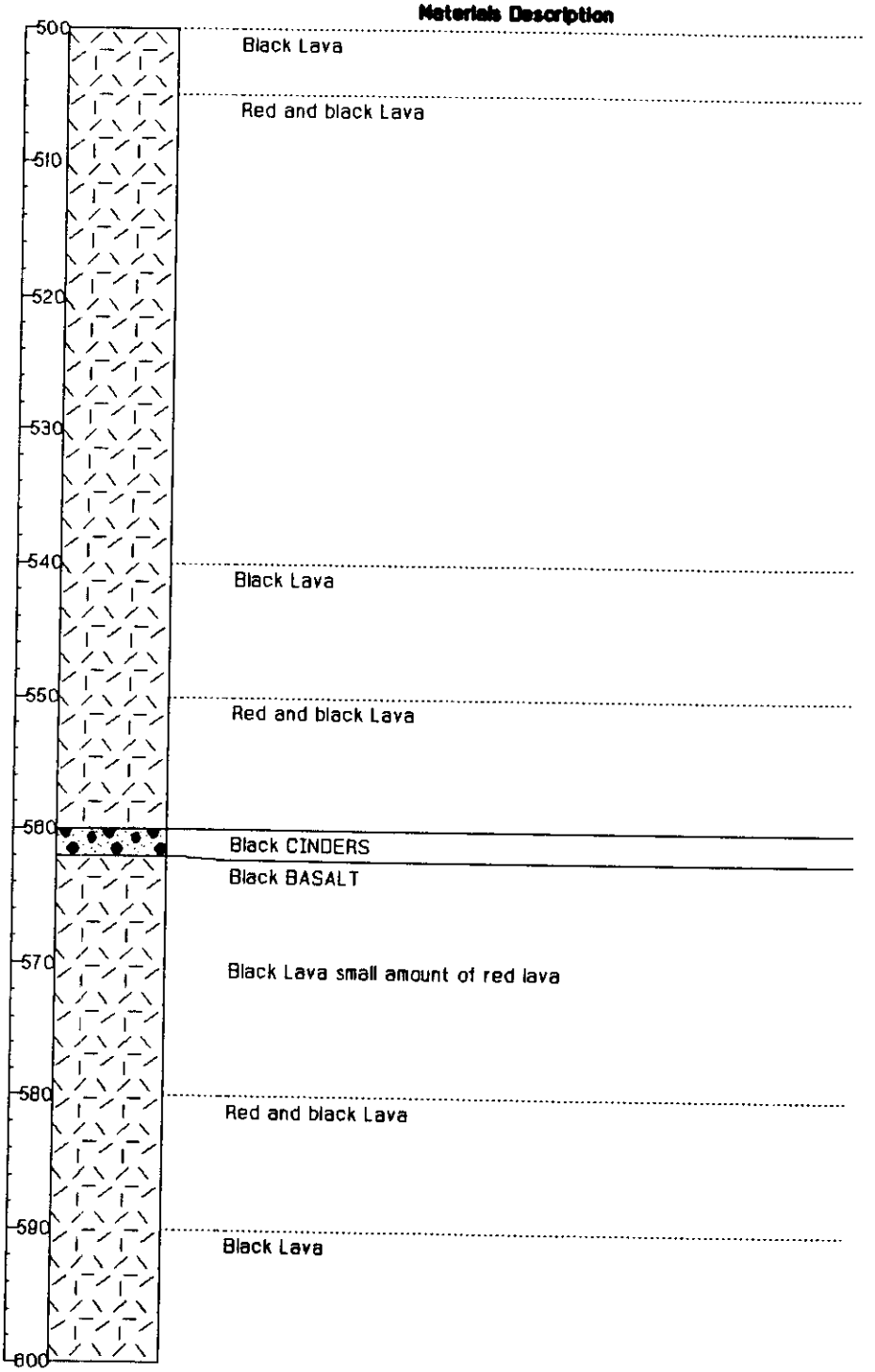


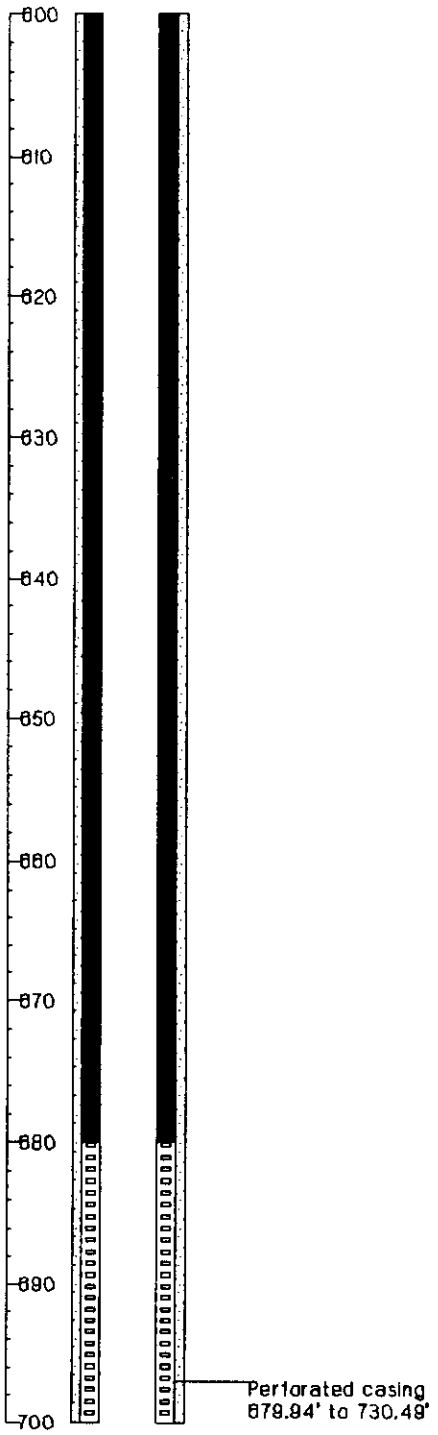
LOG OF WELL Arbor Test

Project Location: Arbor Test Facility Presiting Investigation

Driller: South of SE corner of ANL-W

Total Depth: Cushman and Johnson

Well Description



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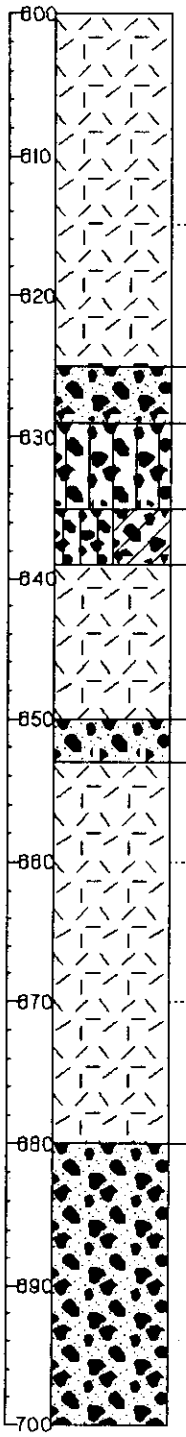


Hard

Gray Lava

Red CINDERS; with gray Basalt

Orange CHALK; with red Basalt ED. Note: unlikely to be Chalk probably Clay or Loess.

Orange CHALK and Brown CLAY; with red and black Cinders

Black BASALT; Soft

Black CINDERS

Red and black BASALT

Black Lava small amount of red

Black and red Lava

Black and red CINDERS

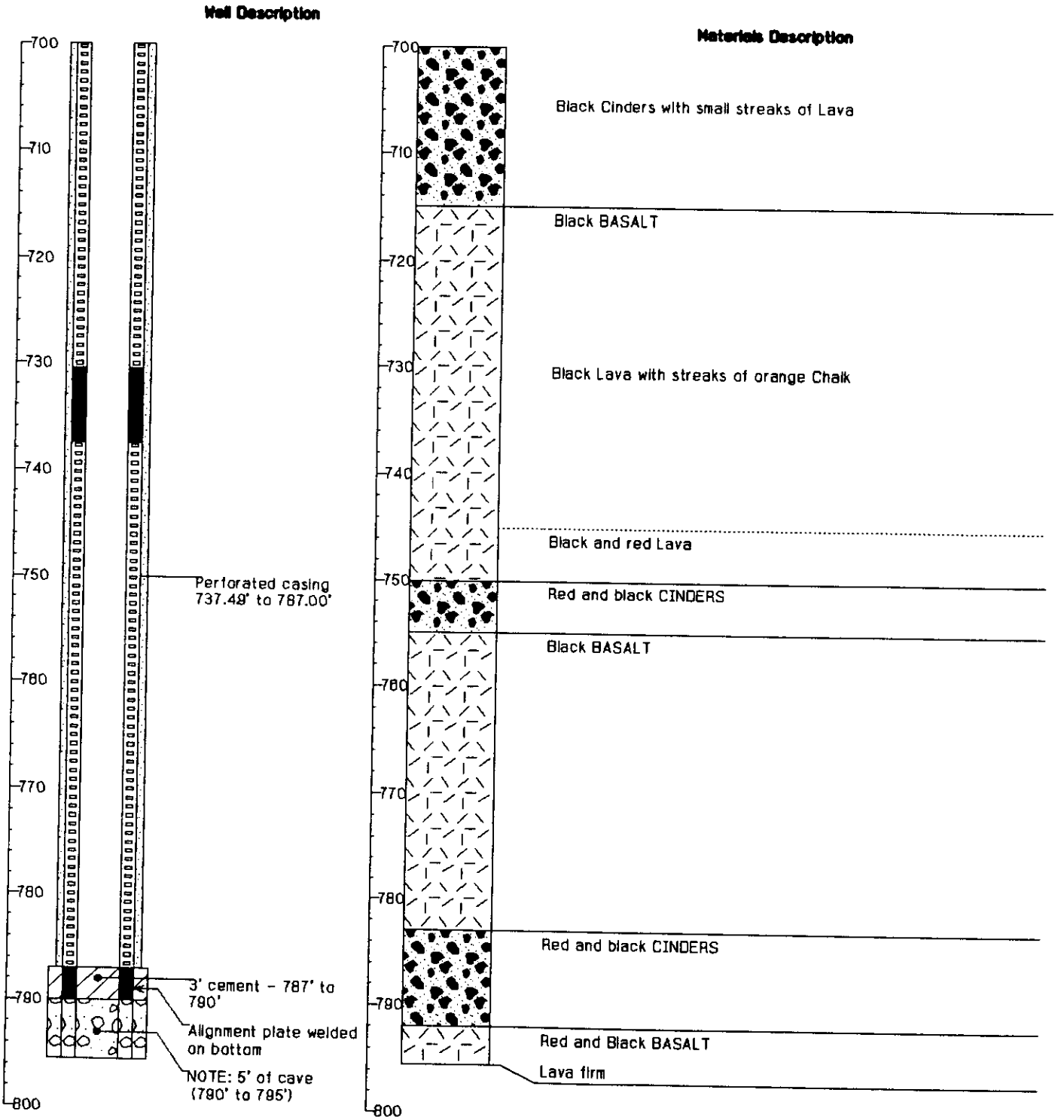
Black Cinders

LOG OF WELL Arbor Test

Project Location: Arbor Test Facility Presiting Investigation

Driller: South of SE corner of ANL-W

Total Depth: Cushman and Johnson

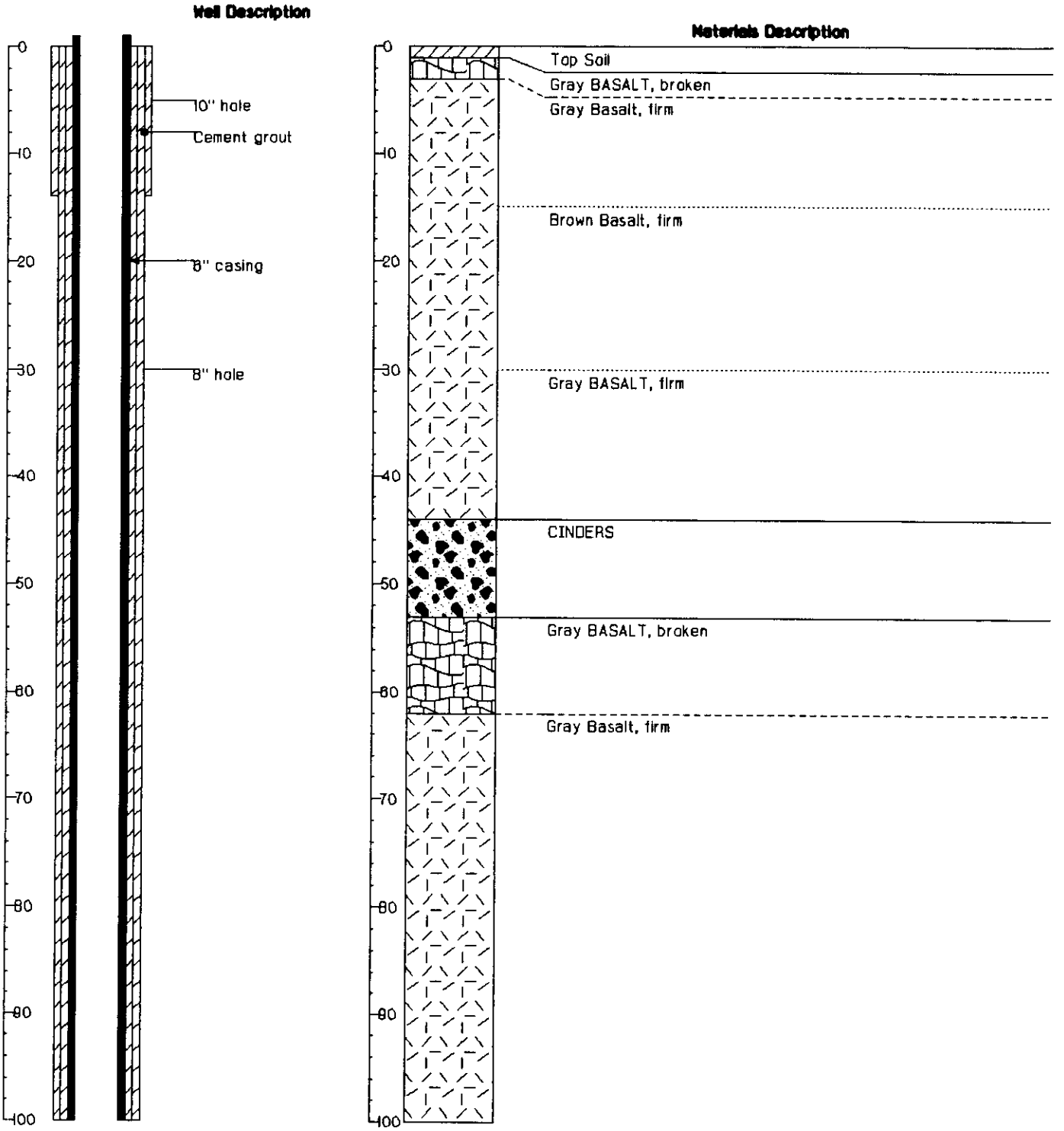


LOG OF WELL USGS 100

Project Location: Site Wide Well Network

Driller: SW of ANL-W approxiamtely 1/2 mile

Total Depth: Andrew Well Drilling



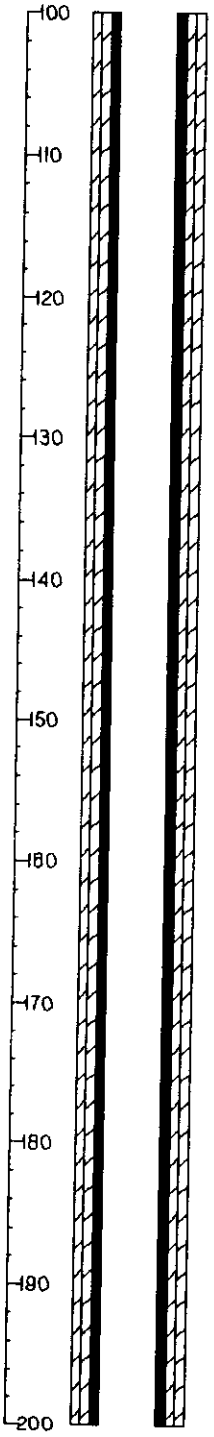
LOG OF WELL USGS 100

Project Location Site Wide Well Network

Driller SW of ANL-W approxiamtely 1/2 mile

Total Depth Andrew Well Drilling

Well Description



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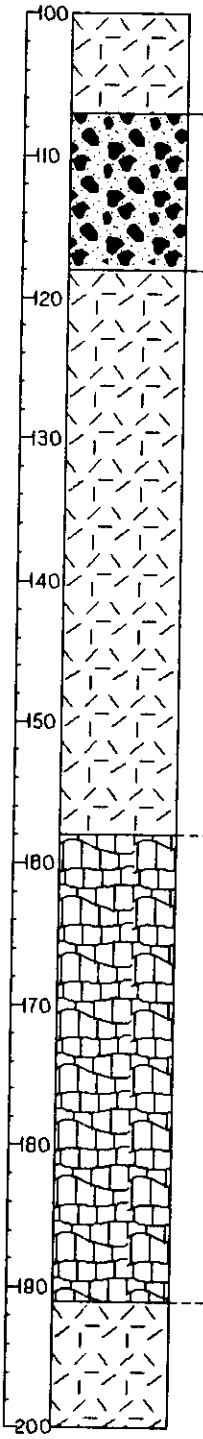


CINDERS

Gray BASALT, firm

Hard

Gray Basalt, broken

Gray Basalt, firm

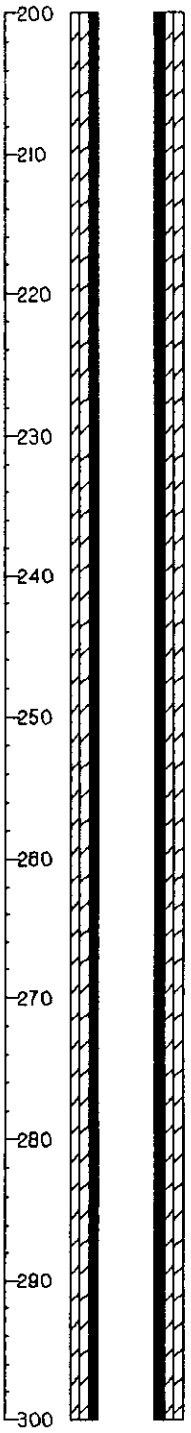
LOG OF WELL USGS 100

Project Location Site Wide Well Network

Driller SW of ANL-W approxiamtely 1/2 mile

Total Depth Andrew Well Drilling

Well Description



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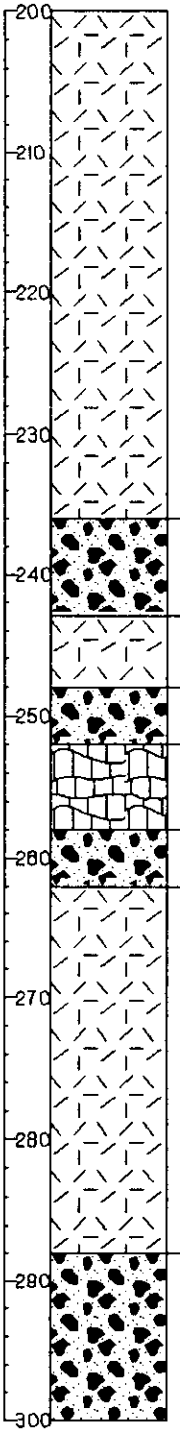


CINDERS

Gray BASALT, firm

CINDERS

Gray BASALT, broken

CINDERS

Gray BASALT, firm

CINDERS

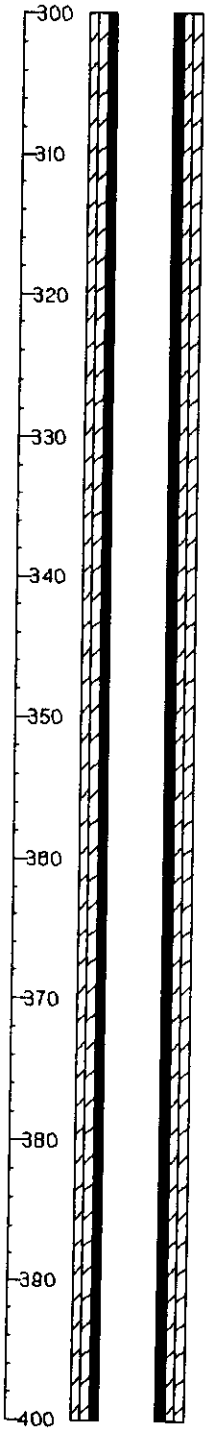
LOG OF WELL USGS 100

Project Location: Site Wide Well Network

Driller: SW of ANL-W approxiamtely 1/2 mile

Total Depth: Andrew Well Drilling

Well Description



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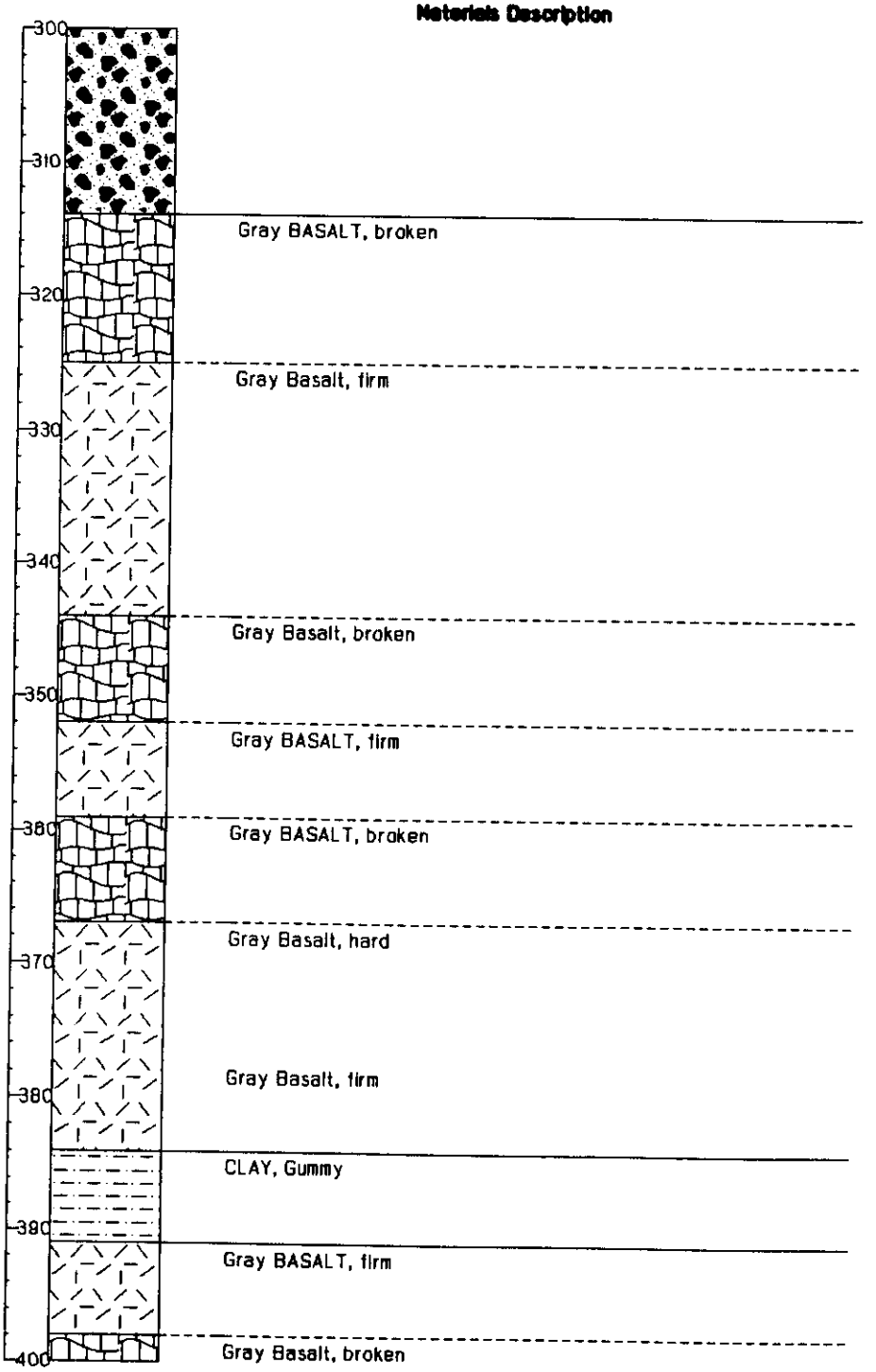

LOG OF WELL USGS 100

Project Location: Site Wide Well Network

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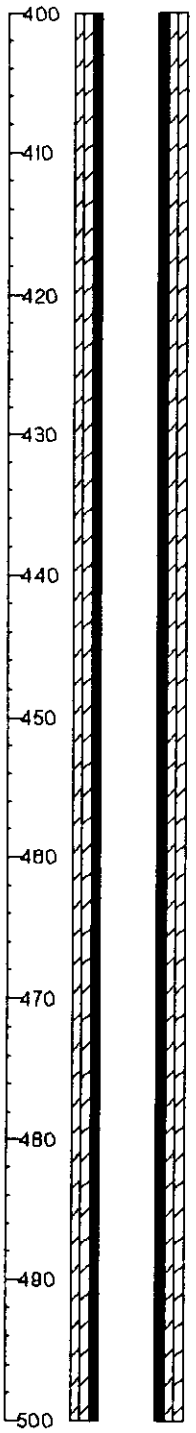
Well Description



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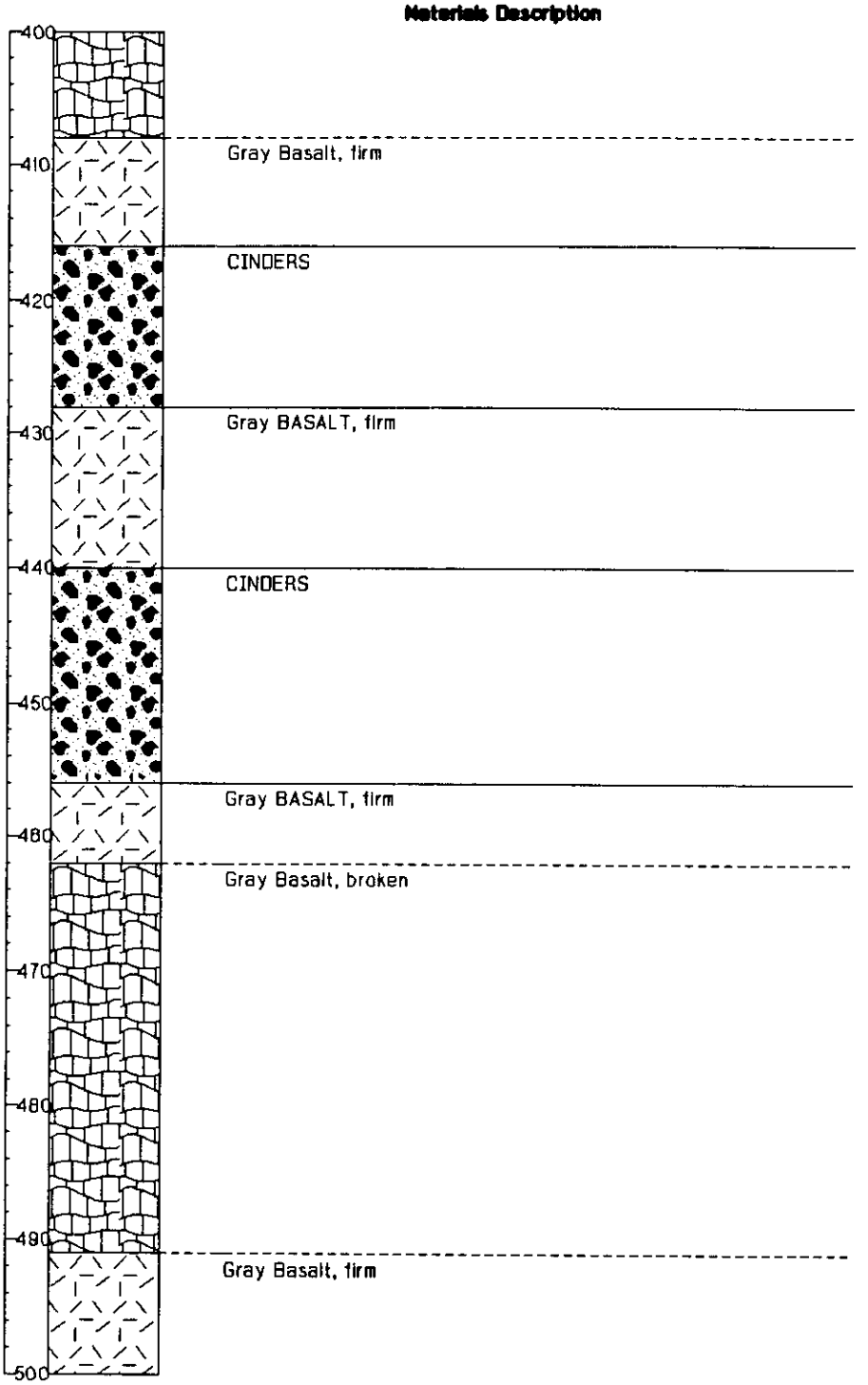

LOG OF WELL USGS 100

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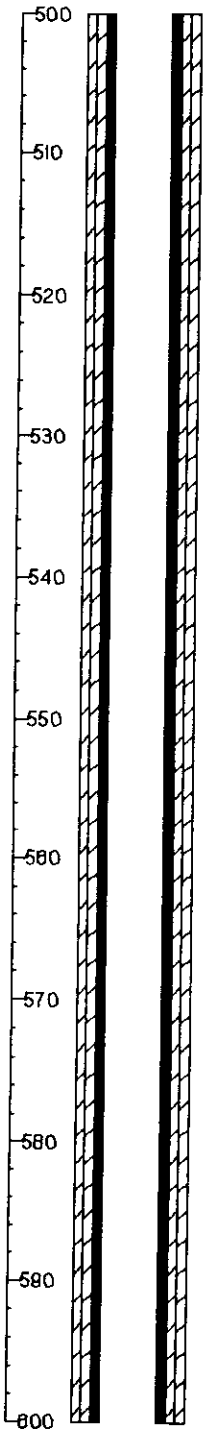

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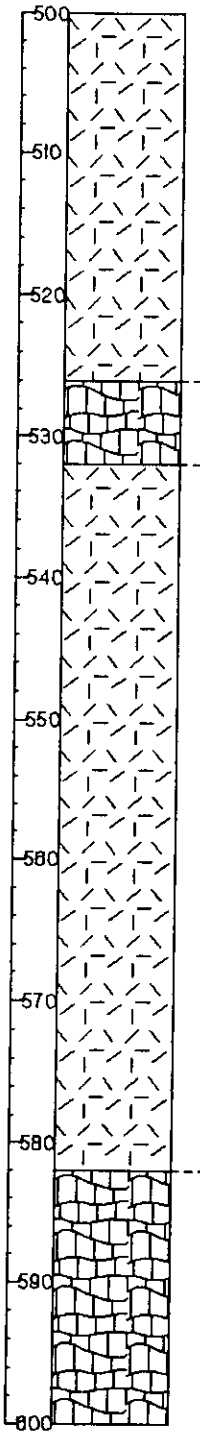


Hard

Gray Basalt, broken

Gray Basalt, hard

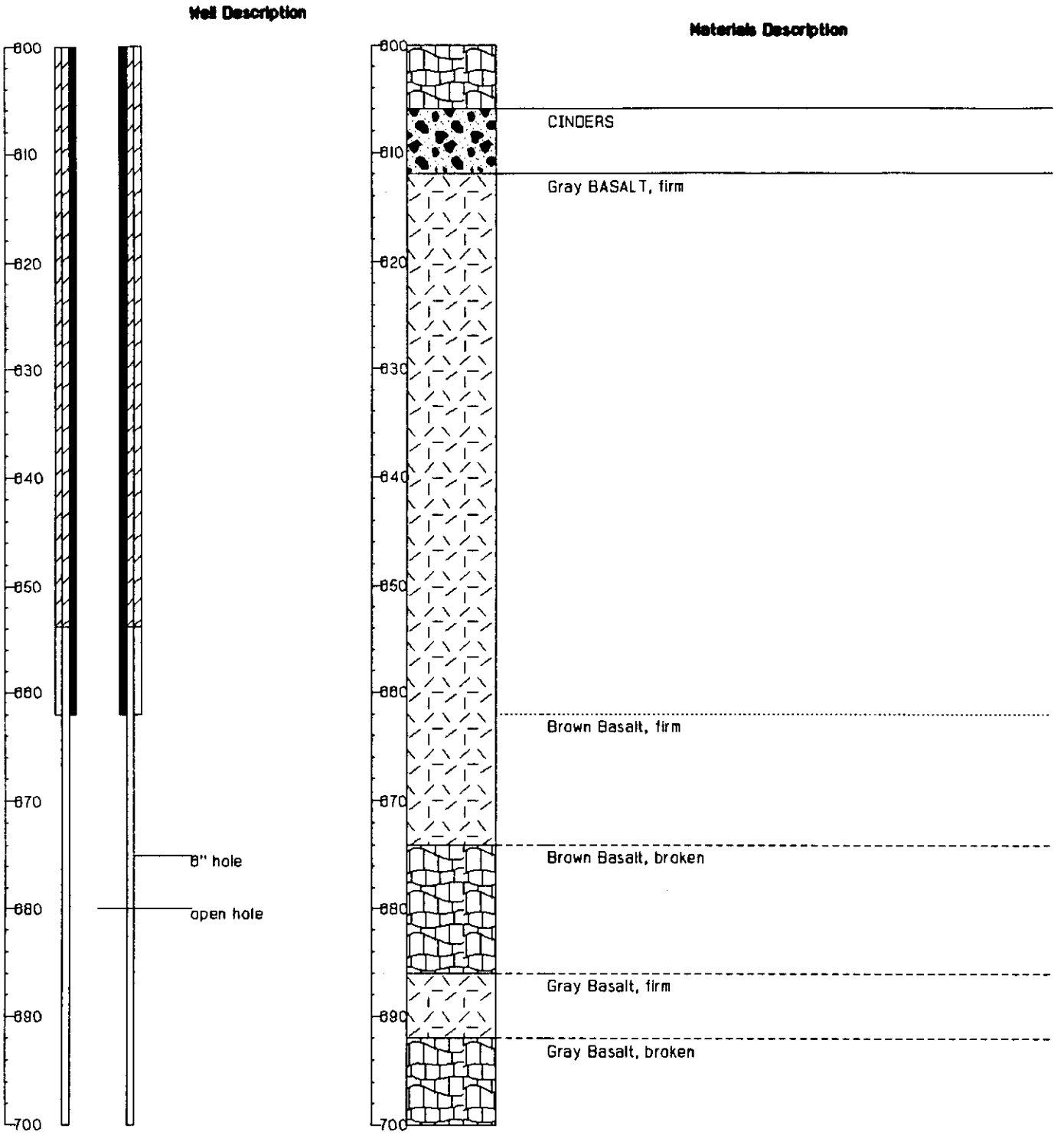
Gray Basalt, broken

LOG OF WELL USGS 100

Project Location Site Wide Well Network

Driller SW of ANL-W approxiamtely 1/2 mile

Total Depth Andrew Well Drilling



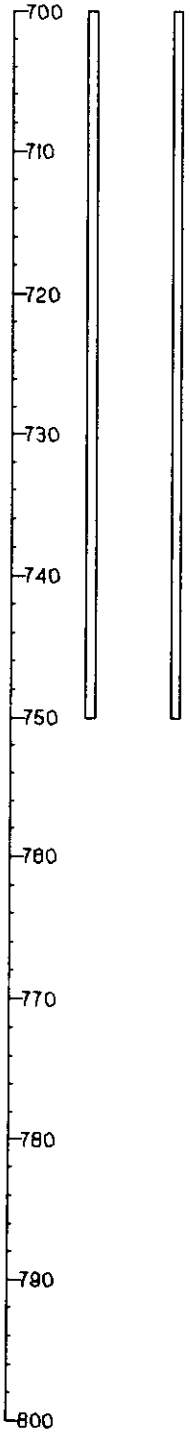
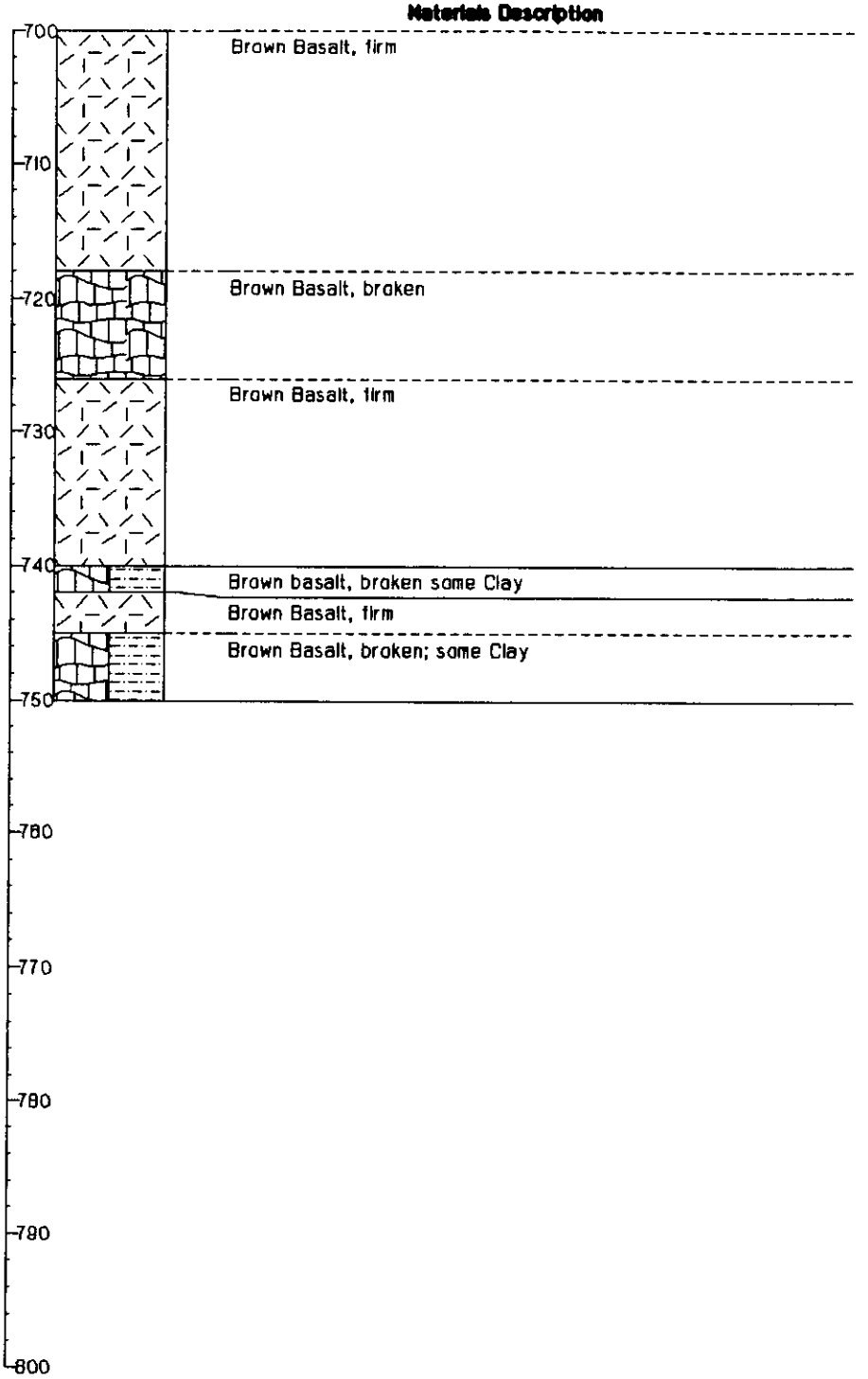
LOG OF WELL USGS 100

Project Location Site Wide Well Network

Driller SW of ANL-W approxiamtely 1/2 mile

Total Depth Andrew Well Drilling

Well Description



Materials Description