

Vaðlaheiðargöng

Viðauki 1

**Kjarnaborholur
Borholulýsingar VK 1 – VK 7**

Skýringar með kjarnaborholum / Legend for coreholes

Date Nov. 2006

Page **1** of **1**

Empl. **Vegagerðin / Greið leið**

Design AgG/GG

Drawn GG/AgG

Coord. X: Y: Elev.:

Driller X

Drilled x

Elev. m a.s.l.	Depth m	Description of corehole - name of corehole	Depth m	Rock column	Core %	RQD % 10 / 30 / 50 / 100	QC	GWT	Perm. (LU) 2,5 5,0 7,5
454,1	150	<p>All core was drilled with NQ triple tube core barrels Diameter of core 44,7 - 45 mm Hole diameter 75,7 mm</p> <p>Tholeiite basalt</p> <p>Olivine basalt</p> <p>Porphyritic basalt</p> <p>Scoria</p> <p>Dyke intrusions (subvertical)</p> <p>Tectonic breccia</p> <p>Sedimentary interbeds (fine grained)</p> <p>Sedimentary interbeds (coarse grained)</p> <p>Percussion drilling at top and complete core loss</p> <p>Rock magnetisation Normal / Reverse / Anomalous $\textcircled{N} / \textcircled{R} / \textcircled{A}$</p> <p>Core loss</p> <p>Jointed rock</p> <p>Marks for drilling intervals</p> <p>Core box number K-31</p> <p>K-32</p> <p>Schmidt hammer test</p> <p>Number of tests 8 Average rebound hardness 12,1</p> <p>Point load test</p> <p>Number of tests 8</p> <p>Average readout strength on PLT instrument 4,9 kN</p> <p>Average calculated apparent UCS strength 51 MPa</p> <p>Conversion of PLI values to Apparent uniaxial compressive strength Apparent UCS values for Icelandic rock fit best to the formula: $UCS = 11 \times PLI^{1,2}$</p> <p>Apparent UCS may also be calculated as: For PLI 1-2 = PLI x 12 For PLI 2-4 = PLI x 14 For PLI 4-6 = PLI x 16 For PLI > 6 = PLI x 18</p> <p>UCS 10 MPa Uniaxial compressive strength, laboratory test</p> <p>NGI Rock classification system Qc Q-value as evaluated on core (not valid for measurements on blasted tunnel walls)</p> <p>Joint roughness</p> <p>Joint sets</p> <p>Joint alteration</p> <p>The joint water and SRF (stress reduction) parameters are evaluated as 1/1 in the boreholes</p> $Q_c = \frac{RQD}{J_n} \times \frac{J_r}{J_a} \times \frac{J_w}{SRF}$	150						
	152			152					
	154			154					
	156			156					
	158			158					
	160			160					
	162			162					
	164			164					
	166			166					
	168			168					
	170			170					
	172			172					
	174			174					
	176			176					
	178			178					
	180			180					
	182			182					
	184		184						
	186		186						
	188		188						
	190		190						
	192		192						
	194		194						
	196		196						
	198		198						
	200		200						

RQD %
10 / 30 / 50 / 100

Percentage of core pieces of over 10 cm,
30 cm, 50 cm and 100 cm continuous core length,
indicating block sizes, within the same rock unit

Core recovery and RQD
is defined by rock units

NGI Rock classification system Qc - value as evaluated on core

Ground water table

Vaðlaheiði Corehole VK - 01 0 - 33,4 m

Date Nov. 2005

Page 1 of 1

Design AgG

Drawn GG

Empl.

Greið leið

Coord. X: 549768,x

Y: 581257,x

Elev.: 174,x

Driller RFS

Drilled Aug. 2005

Elev. m a.s.l.	Depth m	Description of corehole VK - 01	Depth m	Rock column	Core %	RQD % 10 / 30 / 50 / 100	Q	GWT	Perm. (LU) 2,5 5,0 7,5
174,x	0	4" steel casing down to 6,3m. NQ drilling rods, triple tube. Core diameter 45mm.	0						
	2	The coordinates are surveyed with hand held GPS tool, only to an accuracy of some 5 m.	2						
	4	Top of bedrock at 4,5 to 5m depth.	4						
	6		6						
167,7	6								
165,9	8	Olivine basalt strong, microporous, dark grey, scattered vesicles (< 6mm), micropores and vesicles filled with black clay. Several inclined joints with rough and undulating surfaces, coated with grey and black clay. 11 11,5 kN 86 MPa	8		100	0/0/0/0			
	8				100	28/0/0/0			
	8				100	0/0/0/0			
	10	Sediment - silty clayous tephra very low strenght, red brown in the upper part, brown in the lower part. Erodes and crumbles completely during drilling, the hole collapses several times.	10		40	0/0/0/0			
163,1	10				73	0/0/0/0			
	10				16	0/0/0/0			
	10				67	0/0/0/0			
	10				100	0/0/0/0			
	10				100	0/0/0/0			
	10				100	0/0/0/0			
	12	Scoria compact and well cemented, medium strong, dark reddish grey, voids completely filled and cemented with zeolithes, forming continuous mass which breaks during drilling. Sandy infillings near base of scoria. Few original joints. 8 12,1 8 4,9 kN 32 MPa	12		100	0/0/0/0			
	12				100	56/0/0/0			
	14	Intermediate olivine porphyritic basalt strong, but intensely jointed and recemented by zeolithes, medium grey, up to 10% plagioclase phenocrystals. K-1	14		99	21/21/0/0			
	14				84	36/0/0/0			
	16	Several subvertical joints with rough and undulating surfaces, healed by zeolithes. Brown alteration zones around joints. K-2	16		100	30/0/0/0			
	16				98	34/0/0/0			
	18	Scoria well cemented, completely filled with zeolithes, dark reddish grey, tectonised recemented core.	18		89	18/0/0/0			
	18	Intermediate olivine porphyritic basalt high strength, medium dark grey, slightly microporous.	18		70	20/0/0/0			
	20	Highly jointed down to 22m depth, subvertical, healed joints (tectonised but recemented).	20		94	32/3/0/0			
	22	Below the core is intensely jointed, partly recemented.	22		84	0/0/0/0			
	22	Inclined to subvertical joints with rough and undulating surfaces.	22		88	0/0/0/0			
	24	Most joint planes are coated with zeolithes or hard clay. 1 - 2 inclined joints (< 10mm) filled with brown clay. K-2 K-3	24		100	48/0/0/0			
	24				100	55/0/0/0			
	26				100	21/0/0/0			
	26				100	11/0/0/0			
	28	8 20 kN 171 MPa	28		100	40/19/0/0			
	28								
	28								
	30								
	30								
	32	7 22,3	32		99	38/0/0/0			
	32								
	32								
140,6	32	low to medium strenght, well cemented by zeolithes, dark red, 10 - 15% vesicles and voids, mostly filled with zeolithes.	32		96	41/0/0/0			
	34	Bottom at 33,40m depth	34						
	36		36						
	38		38						
	40		40						
	42		42						
	44		44						
	46		46						
	48		48						
	50		50						

**Vaðlaheiði
Corehole VK - 02 0 - 50 m**

Date Nov. 2005

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Design AgG

Drawn GG

Empl. Greið leið

Coord. X: 549221,x Y: 581198,x Elev.: 280,x

Driller RFS

Drilled Aug. 2005

Elev. m a.s.l.	Depth m	Description of corehole VK - 02	Depth m	Rock column	Core %	RQD % 10 / 30 / 50 / 100	Q	GWT	Perm. (LU) 2,5 5,0 7,5
280,x	0	4" steel casing down to 15m. 45° inclined from vertical, towards W. NQ drilling rods, triple tube. Core diameter 45mm.	0						
	2	The coordinates were surveyed with hand held GPS tool, only to an accuracy of some 5 m.	2						
	4	Gravelly and stony surface.	4						
	6	0 - 8 m depth: mix of sandy, gravelly and bouldery material.	6						
	8	Top of bedrock around 8 m depth.	8						
274,3	8	8 - 13 m depth: reddish brown bedrock (probably sediment).	8						
	10		10						
	12		12						
	14	13 - 15 m depth: grey cuttings, probably basalt	14						
269,4	16	Olivine basalt strong, medium grey, 10% vesicles (1 - 6mm diameter), half filled and filled with zeolithes (chabasite).	16		43	0/0/0/0	15/0/0/0		
	16	Scoriaceous basalt medium strength, reddish brown. Compact and well consolidated forming relatively massive rock, almost all vugs and vesicles filled with zeolithes and hard clay. Possible layer contact at 17,9m depth.	16		58	33/0/0/0	31/0/0/0		
	18		18		61	33/0/0/0	Qc = 2,6 - 4,6 $Qc = \frac{31}{9} \times \frac{3-3}{3-4} \times \frac{1}{1}$		
266,7	20	Intermediate olivine porphyritic basalt strong, light to medium grey (in the upper part). 5% vesicles (< 3mm diameter), mainly coated with black clay and partly filled with white zeolithes (chabasite).	20		100	0/0/0/0	158/0/0/0		
	22		22		97	57/0/0/0	86	45/0/0/0	
	24	Medium to dark grey (in the lower part).	24		86	30/0/0/0	Qc = 5 - 7,5 $Qc = \frac{45}{9} \times \frac{3-3}{2-3} \times \frac{1}{1}$		
	26	Intensely jointed, most stumps range from 30 to 40mm length. Thin joints with rough and undulating surfaces, coated with brownish and black clay. Brownish alteration zones around joints.	26		80	53/0/0/0	71	19/0/0/0	
	28	Partly subhorizontal, micropore flow banding.	28		70	0/0/0/0	100	50/0/0/0	
259,4	30	Scoriaceous basalt medium strength, brownish - red, < 15% vesicles (< 6mm diameter), normally half-filled with zeolithes. The core is jointed, mainly due to drilling and handling.	30		44	19/0/0/0	Qc = 2,7 - 4,7 $Qc = \frac{32}{9} \times \frac{3-4}{3-4} \times \frac{1}{1}$		
	32	Sparse joint pattern, healed with zeolithes.	32		95	25/0/0/0	77	32/0/0/0	
255,9	34	Sediment, clayous siltstone low strength, red, waxy surface, probably swelling, breaks and erodes slightly during drilling. tuffaceous at the lowest 30cm.	34		94	0/0/0/0	13/0/0/0		
	34	Scoria - scoriaceous basalt 8cm brown tuffaceous infiltration at the top. medium strength, brownish - grey, 15 - 20% vesicles (< 6mm diameter), filled with opal and dark grey - greenish hard clay.	34		92	26/0/0/0	Qc = 0,4 - 1,3 $Qc = \frac{13}{6-9} \times \frac{2-3}{3-4} \times \frac{1}{2,5}$		
	36		36		93	0/0/0/0	100	63/31/0/0	
	38	Intermediate olivine porphyritic basalt strong, dark - medium grey.	38		88	45/0/0/0	96	58/17/10/4	
	40	Relatively coarse grained basalt with <15% plagioclase phenocrystals (<5mm). Vesicular, vesicles filled and half-filled with zeolithes (chabasite) and black clay.	40		98	72/0/0/0	Qc = 3,2- 6,4 $Qc = \frac{58}{9} \times \frac{2-3}{3-4} \times \frac{1}{1}$		
	42	Moderate joint distribution, joints show various directions and inclinations. Normally thin joint fillings (<1-2mm wide) of hard light brown opal and silt. The joints show frequently 10 to 30mm thick alteration zones, indicating geothermal activity.	42		86	70/21/21/0	100	87/77/77/77	
	44		44		97	43/0/0/0	100	41/0/0/0	
	46		46		100	87/77/77/77			
	48	From 48,5 to 49,2m depth, tectonic joint pattern, white veins of irregular joints healed with zeolithes.	48		100	87/77/77/77			
244,6	50	Tectonised but well recemented and consolidated rock, dark grey, mix of basalt fragments in clayous cement.	50		100	41/0/0/0			

Vaðlaheiði
Corehole VK - 02 50 - 100 m

Date Aug. 2005

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Design AgG

Drawn GG

Empl. Greið leið

Coord. X: 549221,x

Y: 581198,x

Elev.: 280,x

Driller RFS

Drilled Aug. 2005

Elev. m a.s.l.	Depth m	Description of corehole VK - 02	Depth m	Rock column	Core %	RQD % 10 / 30 / 50 / 100	Q	GWT	Perm. (LU) 2,5 5,0 7,5
	50	Intermediate olivine porphyritic basalt strong, dark - medium grey.	50		99	93/57/0/0			
	52		52		100	65/26/26/0			
	54		54		100	44/0/0/0			
	56		56		100	44/0/0/0			
	58	Tectonized zone from 57 to 62,8 m depth	58		100	36/29/0/0			
238,9	58	Olivine basalt strong, dark grey, microporous, all pores filled with black clay and zeolithes. Scattered vesicles (<10mm) filled with black clay.	58		80	54/0/0/0			
	60		60		99	55/37/37/0			
	62	Frequent recemented tectonic joints (spacing 10-30cm) in a relatively well consolidated rock mass with brown alteration zones around healed joints (relatively stable rock for tunneling).	62		86	47/16/16/0			
	62		62		75	38/0/0/0			
235,6	64	Scoriaceous porphyritic basalt medium strength, reddish-brown, vesicular, all vugs and vesicles filled with brown opal and hard clay.	64		88	46/0/0/0			
	66	Intermediate olivine porphyritic basalt strong, medium grey, microporous with scattered rounded vesicles.	66		98	74/23/0/0			
	68	Micropores filled with black clay, larger vesicles coated and half-filled with zeolithes (chabasite).	68		100	64/0/0/0			
	70	Moderately jointed, joints with rough and undulating surfaces with no or only slight clay coating. Brown alteration zones at few joints. Several white veins (zeolithes) of healed joints.	70		100	84/48/29/0			
	72	Tectonised zone (71,5 - 72,3 m), fractured dark rock with white veins in between well cemented basalt fragments yielding continuous massive, well cemented core, slightly reduced average rock strength.	72		97	68/27/10/0			
	74	Open joint at 73,9m depth, surfaces coated by red clay and partly filled with zeolithes, probably water bearing, some loss of drilling water.	74		90	69/15/0/0			
	76	Several inclined and subvertical joints with undulating surfaces coated and sometimes healed with hard opal, clay and zeolithes. Several, 10 - 15cm wide, brown alteration zones around joints.	76		100	73/24/0/0			
	78	Microporous basalt, most micropores filled with black clay, scattered larger vesicles, half-filled with zeolithes (chabasite, stilbite) and dark clay.	78		100	51/32/20/0			
	80	Tectonised zone (80 - 81m), frequent subparallel joints with 10 - 50mm spacing, mainly completely healed with black clay and zeolithes, yielding almost continuous core. From 81 - 83,8 m scattered, steeply inclined joints, healed with black clay and zeolithes.	80		100	51/51/51/0			
	82	At 81m brown alteration color around one 8mm wide joint, filled with brown clay and small basalt fragments.	82		100	53/23/0/0			
	84	Scoriaceous basalt tectonised zone (84,3 - 84,7m)	84		94	76/29/29/0			
	86	Intermediate olivine porphyritic basalt strong, "pale pinky-grey", 10% vesicles (<10mm) half-filled and filled with zeolithes (chabasite), frequent thin white vein pattern of very thin joints, some break during drilling and handling.	86		100	57/0/0/0			
219,0	88	Scoria medium strong, reddish-brown, < 20% vesicles (<10mm) partly filled with opal and zeolithes (chabasite). At 87,9 - 88,4 probable layer contact with brown sandy infillings.	88		100	88/75/0/0			
	90	Scoriaceous basalt / dyke From 89 - 90,5 mix of scoriaceous basalt and dyke veins. From 89,9 - 90,4 clear dyke, with fine grained chilled margin, well welded to surrounding rock, overall strong rock. Some tectonic movement around these dykes is possible.	90		100	87/13/0/0			
	92	Scoria medium strong, reddish-brown, probably layer contact. Few large vugs filled with opal and zeolithes, 20% vesicles (<10mm) always filled with zeolithes and opal.	92		100	84/62/53/53			
	94	Intermediate olivine porphyritic basalt strong, medium grey, 10-15% vesicles (<30mm), mainly half-filled with zeolithes and partly filled with black clay.	94		97	79/31/7/0			
	96	Scattered thin joints with rough and undulating surfaces, coated with black clay.	96		100	80/10/0/0			
	98		98		90	69/15/0/0			
209,3	100	From 97 to 100m strong indication of tectonic stress found in thin but frequent black joint pattern which is completely recemented into a continuous rockmass.	100						

24.08.2005

2,8 LU
at
8 bar

0,5 LU
at
10 bar

Elev. m a.s.l.	Depth m	Description of corehole VK - 02	Depth m	Rock column	Core %	RQD % 10/30/50/100	Q	GWT	Perm. (LU) 2,5 5,0 7,5
203,1	100	Intermediate olivine porphyritic basalt strong, medium grey, <10% vesicles (20 mm) filled with mainly zeolithes.	100		100	95/68/28/0			
	102		102		100	88/26/0/0			
	104		104		100	88/26/0/0			
	106	At 105,7: 5cm wide joint filled and cemented with a mix of scoria and sandstone.	106		95	48/0/0/0			
	108	At 106,2 - 106,9m, tectonised zone, black joint pattern and grey zeolithe cemented veins, heavily tectonised rock but recemented and well consolidated basalt. sharp boundary	108		78	55/37/0/0			
	110	Sediment, silt-claystone moderately weak - weak, dark brownish grey, waxy surface. below 109,1 m: brow. several joints with slicken sides, core erodes during drilling and breaks further during handling, probably slightly swelling clay, at the base the core disintegrates into lumps of gravel and sand size.	110		87	0/0/0/0			
	112	Olivine basalt medium strong - strong, dark grey, 20% vesicles (< 20mm) coated and partly filled with zeolithes and grey clay (concentric structure of the filling, clay in center, zeolithes forming rim).	112		78	13/0/0/0			
	114	Few joints with rough and undulating surfaces, coated with zeolithes.	114		83	0/0/0/0			
	116	Microporous more massive basalt, all pores filled with black clay and sometimes zeolithes. Scattered thin white veins of healed joints.	116		100	93/0/0/0			
	118	15% vesicles (< 10mm) filled with zeolithes, few larger vesicles and vugs with needle zeolithes (scolecite).	118		100	93/0/0/0			
186,0	120	Scoriaceous basalt red, vesicular basalt, vesicles filled with zeolithes. probable layer contact (no sharp contact)	120	100	79/37/24/6				
	122	Olivine basalt strong, dark grey, microporous, all pores filled with black clay and few zeolithes.	122	100	73/38/40/40				
	124	At 122,8 and 123m depth, two joints, open for several mm, white opal and zeolithes cover joint rims, water loss occurred during drilling.	124	100	75/17/17/0				
	126	Moderately spaced thin white veins of healed joints, most cemented, few break up due to drilling and handling.	126	100	77/25/0/0				
	128	Medium strong, 20% vesicles (<20mm) mainly filled with zeolithes and blueish clay.	128	100	91/50/24/0				
	130	layer boundary, 5cm red scoriaceous zone Medium strong, 20% vesicles (<20mm) mainly filled with zeolithes. Scattered pattern of thin white veins of healed joints, formed due to minor stress, not reducing significantly the rock strenght.	130	100	70/0/0/0				
	132	Strong, dark grey, microporous, micropores filled with black clay. 2 - 3 inclined thin joints.	132	100	70/0/0/0				
	134	Sediment, silt-claystone weak - very weak, waxy surface, multicoloured. Black for 5cm at the top, 20cm red, 35cm greenish brown, 40cm red brown, 50cm greenish brown, 40cm dark brown with fragments of light pumice, 5cm grey at the bottom. Rock erodes and breaks during drilling.	134	62	0/0/0/0				
	136	Scoriaceous basalt medium strong, dark grey. Porous, 15 - 20% vesicles (< 10mm), mainly filled with zeolithes. Massive rock, but breaks during drilling and handling.	136	68	0/0/0/0				
	138	Intermediate olivine porphyritic basalt strong, dark grey. 15% platy plagioclase phenocrystals (< 8mm).	138	75	0/0/0/0				
181,0	140	Scoria - scoriaceous basalt moderately strong, dark reddish grey. The rock breaks and erodes slightly over 20cm at 141,3m.	140	78	0/0/0/0				
	142	Porous, 15% pores, mainly filled and cemented with zeolithes. Overall well cemented rock with very few discontinuities.	142	97	87/52/38/0				
	144	At 146m: Few zones where the core crumbles during handling.	144	100	95/87/60/0				
	146	Overall massive rock.	146	100	88/39/0/0				
	148		148	100	85/67/67/0				
	150		150						

36 LU at 6 bar
is already open

0,0 LU at 9 bar
does npt open

Vaðlaheiði

Date Aug. 2005

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Corehole VK- 02 150 - 200 m

Design AgG

Drawn GG

Empl. Greið leið

Coord. X: 549221,x

Y: 581198,x

Elev.: 280,x

Driller RFS

Drilled Aug. 2005

Elev. m a.s.l.	Depth m	Description of corehole VK - 02	Depth m	Rock column	Core %	RQD % 10 / 30 / 50 / 100	Q	Perm. (LU) 2,5 5,0 7,5
	150	Intermediate olivine porphyritic basalt very strong, medium grey. 3 - 5% small platy plagioclase phenocrystals. 2 - 3% pores (< 5mm) healed with black clay. Scattered white and black veins of thin healed joints. Several inclined joints with rough and undulating surfaces, coated with black clay.	150	(N)	100	86/51/0/0		
	152		152		100	87/42/0/0		
	154		154		97	85/63/20/0		
	156	Tectonic breccia from 156,1 - 156,4m depth, medium strong rock, fragments of basalt cemented in black and white zeolithic matrix, well cemented and consolidated.	156			Qc = 6 - 20,3 $Qc = \frac{81}{6-9} \times \frac{2-3}{2-3} \times \frac{1}{1}$		
	158		158		100	76/36/24/0		
	160	Intermediate olivine porphyritic basalt strong - medium strong, dark grey. 3% vesicles (< 10mm) healed with black clay. White and black veins of healed joints.	160		100	46/0/0/0		
	162	Overall very tectonised but recemented and consolidated rock. Few joints with rough and undulating surfaces, coated with black clay and zeolithes.	162		100	97/94/74/0		
	164		164		100	81/37/0/0		
163,3	166	Tectonic breccia from 165 - 167,4m depth, moderately strong rock, intensely brecciated basalt fragments cemented in hard black clayeous matrix. Probably moderate good tunneling rock.	166		100	81/51/39/0		
	168		168		100	100/100/0/0		
160,5	170	Sediment, claystone weak - very weak, waxy surface, multicoloured. topmost 30cm black and darkbrown, 60cm reddish brown, brown down to bottom of layer, silty claystone, mix of fossil soil and acidic tephra.	170		84	43/0/0/0		
	172	Intermediate olivine porphyritic basalt strong, medium dark grey. 15% vesicles (< 10mm) in the upper part, filled with zeolithes (chabasite).	172		71	27/0/0/0	Qc = 0,4 - 0,9 $Qc = \frac{27}{9} \times \frac{2-3}{4-6} \times \frac{1}{2,5}$	
	174		174		100	89/29/0/0		
	176	Dense microporous basalt, 5% vesicles filled with black clay and zeolithes. In zones of 20 - 50cm clustered plagioclase phenocrystals (< 10%).	176		93	79/67/19/0		
	178	From 181,5 - 182,2m the core breaks at joint planes during drilling and handling. The joint planes have rough and undulating surfaces, coated with black clay.	178		96	81/50/22/0		
	180		180	(N)	97	86/61/21/0		
	182	From 174,5 - 175,5m from 180,4 - 186,5 m and from 187 - 187,3m depth frequent pattern of tectonised rock, brecciated basalt healed by white and black veins, yielding overall hard continuous core, most probable relatively stable in excavation.	182		90	53/26/26/0	Qc = 4,5 - 13,5 $Qc = \frac{81}{9-12} \times \frac{2-3}{2-3} \times \frac{1}{1}$	
	184		184		100	87/60/23/0		
	186		186		100	100/57/71/0		
147,6	188	Scoriaceous basalt medium strong - very strong, greyish brown to dark grey. 20% vesicles (< 10mm) mainly coated and filled with zeolithes.	188		100	73/46/0/0		
	190	Very few original joints, the core breaks a bit during drilling and handling, overall well compacted and cemented rock.	190		100	97/52/52/0	Qc = 4,6 - 13,8 $Qc = \frac{83}{9-12} \times \frac{2-3}{2-3} \times \frac{1}{1}$	
	192	Tholeiite strong - dark grey. From 194 - 195m fault breccia, angular basalt fragments (< 50 mm), cemented in hard black clayeous matrix. Some joints healed by zeolithes. The core is well cemented and yielding stable tunneling rock.	192	(N)	100	92/68/47/0		
	194	Dark strong basalt jointed by randomly spaced tectonic joints with rough and undulating surfaces coated with black clay. Core breaks along joints, probably during drilling.	194		96	83/49/33/0		
	196		196		100	63/31/31/0		
	198	Scoria medium strong, reddish grey, vesicular, all vesicles filled with zeolithes, well cemented and consolidated. Tholeiite strong - dark grey, scattered vesicles and vugs, filled with zeolithes (chabasite). Scattered joints with rough and undulating surfaces coated with black clay.	198					
138,6	200	From 198,8 - 199,5m tectonised rock.	200	(N)				

0,0 LU
at
8 bar

does not open



Vaðlaheiði Tunneling Project

JFS-67

Drwg. 1 - 2e

Vaðlaheiði

Date Aug. 2005

Page 5 of 5

Corehole VK- 02 200 - 201,3 m

Design AG

Drawn GG

Empl. Greið leið

Coord. X: 549221,x

Y: 581198,x

Elev.: 280,x

Driller RFS

Drilled Aug. 2005

Elev. m a.s.l.	Depth m	Description of corehole VK - 02	Depth m	Rock column	Core %	RQD % 10 / 30 / 50 / 100	Q	GWT	Perm. (LU)
137,7	200	Tholeiite	200		100	86/47/24/0			
		$\frac{15}{27,3} \downarrow \frac{4}{7,2 \text{ kN}} \times$ Bottom at 201,3 m depth 75 MPa	202						
	202		202						
	204		204						
	206		206						
	208		208						
	210		210						
	212		212						
	214		214						
	216		216						
	218		218						
	220		220						
	222		222						
	224		224						
	226		226						
	228		228						
	230		230						
	232		232						
	234		234						
	236		236						
	238		238						
	240		240						
	242		242						
	244		244						
	246		246						
	248		248						
	250		250						

**Vaðlaheiði
 Corehole VK - 03 0 - 50 m**

Date Nov. 2005

Page 1 of 9

Design AgG

Drawn GG / AgG

Empl. Greið leið

Coord. X: 547.771 Y: 580.513 Elev.: 477 m

Driller RFS

Drilled Sept. 2005

Elev. m a.s.l.	Depth m	Description of corehole VK - 03	Depth m	Rock column	Core %	RQD % 10 / 30 / 50 / 100	Q	GWT	Perm. (LU) 2,5 5,0 7,5
477	0	4" steel casing down to 12m depth. 33° inclined from vertical, towards SE. NQ drilling rods, triple tube. Core diameter 45mm.	0						
	2	The coordinates were surveyed by hand held GPS tool, only to an accuracy of some 5 m.	2						
	4		4						
	6		6						
	8		8						
	10		10						
467	12	Porphyritic basalt (olivine type) very strong, light grey. Scattered vesicles and small pores halffilled with zeolithes and coated with clay. 15 - 20% plagioclase phenocrystals (< 7 mm). Probably compound flows but forming continuous rock mass.	12		52	30/0/0/0			
	14	tectonic breccia from 13,45 - 14,8m depth, fragments of different types of strong basalt cemented in hard black clay and zeolithes, partly brown clayous cementing material of low strength.	14		50	0/0/0/0			
	16	Moderately jointed, frequent joint spacing of 5 - 30cm interval. Randomly spaced thin joints coated with brownish hard clay, opal and zeolithes, rough and undulating joint planes.	16		90	11/0/0/0			
	18		18		100	75/0/0/0			
	20		20		100	62/34/0/0			
	22		22		100	30/0/0/0			
	24		24		97	80/23/0/0			
	26		26		98	64/18/0/0			
	28		28		100	67/29/0/0			
	30		30		100	14/0/0/0			
	32		32		94	61/21/6/0			
	34		34		97	80/33/0/0			
	36		36		95	83/23/0/0			
	38	50cm of porous scoria at the bottom, pores mainly filled with zeolithes.	38		100	0/0/0/0			
445	38	Sediment, Claystone weak - very weak, red. Fine grained silty clayeous core with waxy surface, soft and ductile when wet, probably swelling. 50 cm of crumbled core.	38		22	0/0/0/0			
	40	Light red on the top till 39,5m depth, 39,5 - 41 m dark red, 41m till bottom red brownish red with fragments of light brownish pumice.	40		79	10/0/0/0			
	42	Slickensided surface at some fractures.	42		67	13/0/0/0			
441	42	Scoriaceous basalt (porphyritic type) medium strong, greyish - brown. 10% vesicles (mainly < 10mm), scattered larger vugs, partly filled with small zeolithes (chabasite).	42		100	0/0/0/0			
	44	Probably original joint spacing of 30 - 60cm, but the core breaks during drilling and handling frequently onto 5 - 10cm long stumps.	44		89	48/0/0/0			
	46	Rough and undulating joint planes filled and coated with zeolithes and hard brown clay.	46		96	61/0/0/0			
	48		48		96	68/22/0/0			
	50		50		100	74/33/0/0			
435	50		50		97	83/30/0/0			

30.08.2005

15
33,5

8
10,5kN
80 MPa

13
24,1

8
5,1kN
34 MPa

Vaðlaheiði Corehole VK - 03 50 - 100 m

Date Nov. 2005

Page 2 of 9

Design AgG

Drawn GG / AgG

Empl. Greið leið

Coord. X: 547.771

Y: 580.513

Elev.: 477 m

Driller RFS

Drilled Sept 2005

Elev. m a.s.l.	Depth m	Description of corehole VK - 03	Depth m	Rock column	Core %	RQD %	Q	GWT	Perm. (LU)
						10 / 30 / 50 / 100			2,5 5,0 7,5
435	50	Scoriaceous basalt (porphyritic type)	50			$Q = \frac{10}{6.9} \times \frac{1.2}{3.4} \times \frac{1}{2.5}$			
433	52	Sediment, Claystone weak - very weak, light brown in the upper part, red in the lower part. Probably ductile when wet, probably swelling, erodes during drilling.	52		36	$Qc = 0,1 - 0,6$ 0/0/0/0			
	54	Scoriaceous basalt medium strong, reddish - brown, 15 % vesicles (< 20mm). Half of the vesicles are empty, half are filled with zeolithes. 10 - 20cm joint spacing, thin joints with rough and undulating surfaces.	54		100	34/0/0/0			
	56	Olivine basalt strong, medium dark grey, microporous, scattered vesicles filled with black clay. Faint microporous flow banding.	56		100	17/0/0/0			
	58	Mainly 5 - 50cm well consolidated. fillings of various thickness from < 1mm up to several mm. Undulating joint surfaces, joints with black and brown clay filling.	58		91	25/0/0/0			
	60	At 58m and at 65 - 66m depth brown alteration zones up to 10 cm wide at some joints, indicating flow of thermal water.	60		100	84/69/0/0			
	62		62		98	69/40/0/0			
	64		64		100	$Qc = 3,9 - 13,1$ $Q = \frac{59}{9.10} \times \frac{2.4}{2.3} \times \frac{1}{1}$			
	66		66		100	44/25/0/0			
	68		68		100	59/32/10/7			
419	70	Sediment, claystone weak - very weak, red (greyish pink in the top 10cm). 80cm stratified, fine sandy claystone with some small (< 2mm) light brown pumice fragments. Claystone, very ductile and soft when wet, probably swelling. Due to difficulties during drilling, the hole had to be cemented twice in this layer. 50cm of dark brown claystone with light brown pumice fragments at the bottom.	70		70	0/0/0/0			
	72		72		71	16/0/0/0			
	74	Scoriaceous basalt low to moderate strenght, mottled grey and brown. Clayey brown infillings in grey highly vesicular basalt fragments. 20% vesicles (< 0,5cm) completely filled with zeolithes. Core erodes slightly during drilling.	74		66	6/0/0/0			
	76	Intermediate porphyritic olivine basalt strong, medium grey. Two vesicular zones (25cm) with 7% elongated vesicles (< 1cm), vesicles filled and half-filled with zeolithes. Porous, pores filled with black clay, clay smears during drilling, giving the core a metallic outlook.	76		100	78/52/40/0			
	78	At 82,25m one healed joint, 1mm wide, healed with white and brown clay and opal, rough scratching joint surface. 10cm wide altered zone around joint.	78		100	83/46/17/0			
	80		80		100	$Qc = 4,8 - 16$ $Qc = \frac{72}{9.10} \times \frac{2.4}{2.3} \times \frac{1}{1}$			
	82	Porous, pores filled with black clay, clay smears during drilling, giving the core a metallic outlook. 1-2% vesicles (< 1mm), mostly filled with zeolithes, few larger vugs coated with zeolithes. Very few original joints.	82		99	72/40/27/0			
	84		84		100	78/64/39/0			
	86	From 86m: several joints (spacing approximately 40cm) with rough and undulating surfaces, healed and coated with white and brown clay. 50cm vesicular basalt at the bottom, 3% vesicles (< 2,5cm) filled and half-filled with dark grey clay. 20cm sedimentary interlayer, red claystone	86		100	88/56/56/0			
403	88	Scoriaceous basalt medium strong, reddish brown Highly vesicular, 20% vesicles (< 8mm) filled and half-filled with zeolithes and gray and brown clay. Very few original joints.	88		100	30/0/0/0			
	90	Olivine basalt strong, medium grey. Porous, pores filled with black clay, 1 - 2% scattered vesicles (< 2cm), mostly filled with grey clay and zeolithes. 30 - 50cm joint spacing, joints with rough and undulating surfaces, healed and coated with brown opal. Scoriaceous for 30cm at the bottom.	90		100	57/0/0/0			
	92		92		100	100/0/0/0			
	94		94		100	98/50/50/0			
	96	Sediment, claystone weak - very weak, dark red, probably swelling, fragments of dark grey and light brown pumice (< 2mm).	96		100	94/59/0/0			
	98	Scoria moderately strong - strong, brownish grey. Several brown clayey - fine sandy infillings. Vesicular, 10% large vesicles (< 15mm) mostly filled with zeolithes or dark brown clay.	98		100	$Qc = 5,5 - 18,2$ $Qc = \frac{82}{9.10} \times \frac{2.4}{2.3} \times \frac{1}{1}$			
394	100	Sediment, silt- claystone weak - very weak, reddish brown, soft, ductile when wet, probably swelling, brown in the lowest 40cm, with scattered light brown pumice fragments.	100		76	82/29/6/0			
					100	90/14/0/0			
					89	57/17/0/0			
					100	$Qc = 0,2 - 0,8$ $Qc = \frac{13}{6.9} \times \frac{1.2}{3.4} \times \frac{1}{2.5}$			
					100	0/0/0/0			
					76	17/0/0/0			
					86	14/0/0/0			

Elev. m a.s.l.	Depth m	Description of corehole VK - 03	Depth m	Rock column	Core %	RQD % 10 / 30 / 50 / 100	Q	GWT	Perm. (LU)			
									2.5	5.0	7.5	
393	100	Olivine basalt 20% vesicles (< 0,8cm) filled and half-filled with zeolithes, some larger vugs filled with zeolithes. strong, medium grey, porous, pores filled with black clay	100	(R)	98	38/0/0/0						
	102	1 - 2% vesicles (< 2,5cm) filled and half-filled with zeolithes, several larger vugs filled and half-filled with zeolithes, sometimes coated with blue clay.	102		95	31/0/0/0						
	104	Few original joints (spacing 80cm), rough and undulating joint surfaces coated with light brown, brown and black clay.	104		99	49/0/0/0						
	106		106	(R)	100	59/0/0/0						
387	108	Sediment, claystone 10 cm dark red weak - very weak, brownish-reddish yellow. Soft and ductile when wet, probably swelling, core breaks up during drying. Core breaks along slickensides during drilling.	108		81	0/0/0/0						
	110	Sedimentary flow banding from 108,4 - 110,2m. Overall high core loss and very difficult drilling.	110		94	30/0/0/0						
	112	From 111,6m till bottom higher proportion of light brown pumice fragments.	112		81	23/0/0/0						
383	114	Scoriaceous basalt olivine type moderately strong - strong, medium grey approximately 5% vesicles (< 0,5cm) filled with zeolithes, several large vugs (5cm) coated with blueish clay. Few joint planes with rough and undulating surfaces.	114	(R)	100	52/0/0/0						
	116	Sediment, claystone light brown, mottled outlook due to sandy size pumice fragments. weak - very weak, yellowish brown. The core is soft and ductile, it can be moulded by hand when wet, probably swelling. Overall high core loss and very difficult drilling, the hole has to be cemented twice in this layer.	116		93	16/0/0/0						
	118	118 - 119,2m: greyish brown claystone with scattered light brown pumice fragments.	118		20	0/0/0/0						
	120	At 119,2m: 10cm interbedded brown black tephra layer.	120		67	0/0/0/0						
	122	118 - 120,6m: nearly continuous core recovery. 119,3 - 122,8m: yellowish brown claystone, scattered small fragments of light brown pumice.	122		91	0/0/0/0						
374	124	Scoriaceous basalt porphyritic type moderately strong, reddish dark grey. Highly vesicular (10 - 20%) in zones of 30 cm length, vesicles mostly filled with zeolithes, sometimes coated and half-filled with brown and black clay. Several large vugs (< 7cm) coated with zeolithes. The core breaks at these vugs, also possible water loss during drilling here.	124	(A)	100	72/30/0/0						
	126	at 123,4m 15cm of very faint tectonic stress pattern.	126		97	68/25/0/0						
	128	Sediment, pumice weak, light yellow-brown clayey pumice, waxy surface. Core breaks during drilling and handling.	128		80	40/0/0/0						
370	130	Scoriaceous basalt medium strong, reddish - grey, 15 % vesicles filled with white zeolithes, few rough joints.	130	(N)	100	68/0/0/0						
	132	Sediment, tephra weak, yellow-brown, waxy, crumbles partly.	132		100	48/48/48/0						
	134	Scoria - Scoriaceous basalt medium strong, purple brown, consolidated, forming compact rock mass. 15 % vesicles and vugs, mainly filled with white zeolithes.	134		100	35/0/0/0						
	136	Intermediate Olivine - Porphyritic basalt More compact in the lower part.	136		100	84/60/29/0						
	138	Tholeiite strong, medium grey, microporous flow banded but hard rock. 2 - 3 % vesicles (< 10mm), coated and filled with black clay. Small pyrite crystals.	138		100	55/41/16/0						
	140	at 139 m: few healed joints	140		90	0/0/0/0						
	142	Frequent inclined joints with rough and undulating surfaces, coated with black and sometimes brown hard clay.	142		95	52/17/0/0						
	144		144		100	38/0/0/0						
	146		146		100	57/29/0/0						
	148		148		100	86/68/20/0						
351	150	Hard and brittle, medium grey.	150		98	61/24/0/0						

does not open max. pressure 12 bar

Elev. m a.s.l.	Depth m	Description of corehole VK - 03	Depth m	Rock column	Core %	RQD %	Q	GWT	Perm. (LU)
						10 / 30 / 50 / 100			2,5 5,0 7,5
351	150	Tholeiite strong, medium grey, hard and brittle.	150		100	46/0/0/0			
	152	Frequent inclined joints with rough and undulating surfaces, coated with black clay. K-16	152		100	33/0/0/0			
	154	Scattered pattern of black thin veins of irregular healed and cemented joints. K-17	154		100	0/0/0/0			
	156		156		100	40/40/0/0			
	158	Scoria medium strong, purple - dark grey. Compact and well consolidated. 10 - 15% vesicles and vugs (< 20mm), filled with white zeolithes and calcite.	158		80	50/23/23/0			
	160	Layer contact at 159,7 m, red-brown sandy sediment with scoria fragments. K-17	160		98	$Q_c = \frac{14}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$	Qc = 0,9 - 3,1		
	162	Tectonic breccia, medium strong, well cemented fragments of scoria and basalt. K-18	162		28	72/31/0/0	14/6/2/0		
	164	Olivine basalt medium strong, dark grey, porous.	164	(N)	100	61/37/0/0			
	166	Intensely jointed, dark alteration colour. Black clay filling small pores and joints.	166	(N)	100	26/0/0/0			
	168	Basalt of low strength.	168		100	25/0/0/0			
336	168	Sediment, claystone weak, very dark grey - red at top 0,6m, then dark reddish for 0,8 m, then light yellowish brown tuffaceous claystone, greenish light brown in the lower part. K-18	168		82	30/0/0/0	$Q_c = \frac{38}{6-9} \times \frac{1-2}{3-4} \times \frac{1}{2,5}$	38/10/2/0	
	170	Waxy surface, probably swelling material. K-19	170		98	44/14/0/0	Qc = 0,4 - 1,7		
	172	Olivine basalt strong, dark grey, 15 % vesicles (< 40 mm), half-filled with black clay.	172		100	68/0/0/0			
	174	More massive than above, very strong, medium grey.	174		89	55/0/0/0			
	176	Scattered joints with rough and undulating surfaces, coated with black clay. Pattern of black thin veins of healed joints.	176		88	27/0/0/0			
	178	Very strong, medium grey, slightly microporous, relatively massive basalt.	178		98	73/26/0/0	Qc = 4,5 - 14,9		
	180		180		96	$Q_c = \frac{67}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$	67/28/10/0		
	182		182		100	78/38/19/0			
	184	Vesicular at the base, 5 - 10 % vesicles (<5 mm). K-19	184	(N)	97	70/40/29/0			
322	186	Sediment, claystone weak - very weak, dark brown - grey at top 0,3 m. Reddish brown and yellowish brown tephra, very waxy core. K-20	186		95	$Q_c = \frac{69}{6-9} \times \frac{1-2}{3-4} \times \frac{1}{2,5}$	69/22/0/0		
	188	Scoriaceous basalt strong, dark reddish grey. Very compact scoria, all vesicles and vugs (10 %) are filled with white zeolithes. K-21	188	(N)	97	89/68/43/0	Qc = 5,9 - 19,8		
	190		190		98	$Q_c = \frac{89}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$	89/71/46/0		
316	192	Sediment, claystone very weak, very weak, light yellowish - brown, waxy surface.	192		80	0/0/0/0	Qc = 0,1 - 0,4		
	194	Scoria - scoriaceous basalt / sediment moderately weak, dark grey and green sediment. Core breaks into stumps during drilling and handling. In scoria 10 - 15% vesicles, filled with zeolithes.	194		100	100/50/0/0	$Q_c = \frac{80}{9-20} \times \frac{1-4}{2-4} \times \frac{1}{1}$	Qc = 1,0 - 17,8	
	196	Porphyritic basalt strong - very strong, medium grey. < 10 % vesicles (< 10mm), filled with black clay, in the upper part. Approximately 15 % plagioclase phenocrystals (< 5 mm)	196	(N)	100	75/18/0/0	80/24/0/0		
	198	Medium jointed, joints with rough and undulating surfaces, coated with black clay. K-22	198		100	108/108/108/0			
309	200		200		99	94/89/63/0			

Elev. m a.s.l.	Depth m	Description of corehole VK - 03	Depth m	Rock column	Core %	RQD % 10/30/50/100	Q	GWT	Perm. (LU) 2,5 5,0 7,5
309	200	Porphyritic basalt	200		99	77/46/34/0			
	202		202		99	Qc = 5,1 - 17,1 $Qc = \frac{77}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$			
	204		204		96	75/43/32/0			
	206		206		100	76/17/17/0			
	208		208		100	33/21/0/0			
		Scoria, medium strong, purple - brown, well compact.							
302		Sediment, claystone							
	210	weak - very weak, topmost 0,3m dark red - brown, 1 m reddish, 2 m yellowish brown and green, 1 m light red - brown, 1,5 m light green.	210		79	58/44/0/0			
	212	Tuffaceous stratified claystone, waxy surface, very low strenght, probably swelling clay minerals.	212		80	37/11/0/0			
	214	The core crumbles in to small fragments, partly ductile clayeous material.	214		100	0/0/0/0			
				100	33/0/0/0				
296	216	Scoria - scoriaceous basalt, porphyritic type Medium strong - reddish grey, compact porous rock. Approximately 15 % pores, filled with zeolithes yielding continuous core.	216		100	95/47/47/0			
	218	Porphyritic basalt very strong, medium grey. Approximately 15 % plagioclase phenocrystals (< 6 mm)	218		98	95/95/95/95			
	220	Micropores and small pores coated and sometimes filled with black clay and chabasite. Relatively solid and competent tunneling rock. Very few joints, some are healed with black clay and zeolithes.	220		100	97/97/70/70			
	222		222						
	224		224		99	97/93/81/54			
	226	Very massive basalt, 10 - 15 % plagioclase phenocrystals. Few joints with rough and undulating surfaces with thin clay coating.	226		100	98/98/82/0			
	228		228			Qc = 6,2 - 20,7 $Qc = \frac{93}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$			
	230		230		100	93/83/71/44			
	232		232			95/71/43/0			
	234	Tectonised joints, completely healed with hard opal, up to 10 mm thick gauge.	234		99	89/72/72/51			
	236		236			93/86/72/72			
	238		238		100	57/44/44/0			
	240	Scoriaceous basalt medium strong, reddish brown, porous, approximately 10 % vesicles filled with light yellow brown opal. No obvious layer contact, competent tunneling rock.	240		100	89/89/89/89			
	242	Porphyritic basalt very strong, medium grey. 10 - 15 % plagioclase phenocrystals, 10 - 15 % vesicles and vugs, well filled with zeolithes.	242		100	88/79/67/48			
	244	Brown alteration zone around subvertical joint (healed with 1-3 mm thick zeolithe filling).	244		100	87/66/41/0			
	246	Massive basalt, few scattered subvertical joints, all healed with zeolithes, forming white 1 - 2 mm thick veins.	246			99/91/74/74			
	248		248		99	97/97/97/83			
267	250		250						

0,3 LU
at
13 bar

Elev. m a.s.l.	Depth m	Description of corehole VK - 03	Depth m	Rock column	Core %	RQD %	Q	GWT	Perm. (LU)
						10 / 30 / 50 / 100			2,5 5,0 7,5
267	250	Porphyritic basalt very strong, medium grey, 10 - 15 % plagioclase phenocrystals (> 5mm), scattered vesicles (< 20 mm) filled with zeolithes.	250		100	94/86/84/49			
	252		252		100	93/92/92/0			
	254	Few scattered white subvertical joint veins, completely healed with zeolithes. Massive competent tunneling rock.	254		100	96/96/96/96			
	256		256		100	100/100/100/100			
	258		258		100	Qc = 6,3 - 20,9 $Qc = \frac{94}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$			
	260		260		100	76/37/35/0			
257	262	Sediment, claystone very weak, dark reddish grey at the top 0,4 m, followed by 0,4m of red claystone. Light yellowish, red in the lower part, waxy core, crumbles and erodes during drilling. Core loss in the lower part.	262		47	0/0/0/0 Qc = 0,1 - 0,4 $Qc = \frac{10}{6-10} \times \frac{1-2}{3-4} \times \frac{1}{2,5}$			
	264	Mix of sediment and scoria Scoria - scoriaceous basalt medium strong, dark grey, vesicular, vesicles filled with green and dark clay. Olivine basalt vesicular on top 0,2 m tectonic breccia	264		100	0/0/0/0			
	266	Olivine basalt strong, dark grey, 10 % vesicles (< 20 mm), filled with white zeolithes and black clay.	266		64	40/23/23/0			
	268		268		78	Qc = 3,9 - 13,1 $Qc = \frac{59}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$			
	270		270	87	59/38/10/0 79/52/0/0				
250	272	Tectonic breccia medium strong, rock mass mixed with dyke intrusion. Fragments of different kind of basalt. Scoria and dyke material well cemented in opal and hard clay.	272	90	0/0/0/0				
	274	Olivine basalt very strong, dark grey, medium grain size, microporous, pores filled with black clay.	274	98	Qc = 0,4 - 1,3 $Qc = \frac{60}{15-20} \times \frac{1}{3-8} \times \frac{1}{1}$				
	276	5 cm wide joint, healed with greenish jaspis. Reddish scoriaceous olivine basalt, medium strong, < 15 % vesicles (< 20 mm) filled with zeolithes.	276	99	60/52/24/0 66/58/26/0				
	278	Grey vesicular basalt. Massive microporous olivine basalt.	278	100	100/0/0/0				
	280		280	100	95/82/54/37				
241	282	Sediment, claystone very weak, red at the top 0,5 m, then yellowish brown clayous fine grained acidic pumice. Argillaceous, swelling claystone with waxy surfaces and slickensides on joints. Core crumbles at the base.	282	82	Qc = 6,1 - 20,4 $Qc = \frac{92}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$				
	284	Olivine basalt strong, dark grey but with vesicular zones with 10 - 15 % vesicles (< 15 mm), filled with white zeolithes.	284	98	92/68/47/30 92/82/59/35				
	286	Tectonic joint, 3 - 5 cm wide, well recemented with zeolithes.	286	88	45/56/18/0				
	288	Tectonic joint, 5 cm wide, recemented with zeolithes. Tectonic joint, 3 - 5 cm wide, recemented but partly open. Water loss during drilling, drop of groundwater table down to 83m hole depth. Tectonic fault zone, well cemented and healed with zeolithes.	288	97	81/81/42/0 Qc = 5,4 - 18 $Qc = \frac{81}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$				
	290	Layer contact, reddish brown scoriaceous olivine basalt.	290	100	100/100/46/0				
	292	More massive, strong microporous olivine basalt, 2 - 3 joints filled with zeolithes.	292	98	91/74/30/0				
	294	Scoriaceous olivine basalt strong rock, reddish dark grey, 10 % vesicles and vugs, well filled and cemented with white zeolithes forming relatively massive and competent tunneling rock.	294	100	69/41/0/0				
	296	The scoriaceous basalt is containing tectonic brecciated rock, all well cemented and consolidated white pattern of zeolithes all over the core.	296	97	95/63/47/0				
	298	At 289m depth the groundwater table drops to 82,8m hole depth, also a loss of drilling water occurs.	298	100	Qc = 6,1 - 30,7 $Qc = \frac{92}{6-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$				
225	300		300	100	79/40/40/0				

Vaðlaheiði
Corehole VK - 03 300 - 350 m

Date Nov. 2005

Page 7 of 9

Design ÁGG

Drawn GG / ÁGG

Empl. Greið leið

Coord. X: 547.771 Y: 580.513 Elev.: 477 m

Driller RFS

Drilled Oct. 2005

Elev. m a.s.l.	Depth m	Description of corehole VK - 03	Depth m	Rock column	Core %	RQD %	Q	GWT	Perm. (LU)
						10 / 30 / 50 / 100			2,5 5,0 7,5
225	300	Scoriaceous olivine basalt	K-32 K-33	300					
	302	unclear boundary	11	302	100	96/87/87/49			
	304	Porphyritic olivine basalt Very strong, medium dark grey, 5 - 10 % thin plagioclase phenocrystals, microporous and micropore flow banding, small pores filled with black clay. 5 - 10 % plagioclase phenocrystals (< 4 mm)	6,4 kN 42 MPa	304	100	90/50/0/0			
	306		11	306	99	74/34/0/0			
	308		15,2 kN 130 MPa	308	97	60/39/39/0			
	310	Tectonic joints, mainly cemented with black clay zeolithes, < 30 mm gauge material.	K-33 K-34	310	100	60/0/0/0			
	312	Frequent joint pattern down the entire layer. Half of the joints are healed with white zeolithes and balck clay. Clay gauge (< 2mm thick), joints with rough and undulating surfaces.		312	100	65/18/0/0			
	314			314	100	52/22/22/0			
	316			316	100	79/59/43/0			
	318		9 17,8 kN 151 MPa	318	80	75/33/0/0			
	320	Scoriaceous basalt	K-34 K-35	320	100	90/60/25/0			
208	320	Sediment, sandstone red		320	100	100/0/0/0			
	322	well cemented layer contact		322	92	92/92/0/0			
	322	Scoriaceous porphyritic basalt medium strong, reddish brown with 7 - 10 % vesicles (< 30 mm). 10 - 15 % plagioclase phenocrystal needles (< 10mm). All vesicles filled with white zeolithes.		322	100	92/92/92/0			
	324		12 6,7 kN 45 MPa	324	98	92/92/82/0			
	324	Sediment, sandstone medium strong, dark brown, 5 cm.		324	94	94/94/94/0			
204	324			324	25	0/0/0/0			
	326	Scoriaceous basalt medium strong, brownish grey, approximately 20 % vesicles (< 20mm). All vugs filled with zeolithes.	K-35	326	100	100/93/71/0			
	328	Intermediate porphyritic olivine basalt strong, dark grey, microporous, all micropores filled with black clay and zeolithes. Scattered joints, healed with zeolithes, forming thin white veins. 5 - 10 % plagioclase phenocrystals (< 7mm)	open joint open joint	328	98	82/82/62/37			
	330			330	98	86/76/51/13			
	332	Competent tunneling rock.	10 14,2 kN 121 MPa	332	100	100/100/63/0			
	334	Unclear diffuse boundary.		334	91	60/17/0/0			
	336	Scoriaceous basalt strong, reddish brown, approximately 10 % vesicles filled with zeolithes. Unclear diffuse boundary.	12 6,7 kN 44 MPa	336	100	100/100/89/0			
	338		K-36 K-37	338	100	100/88/41/41			
	340	Tectonised zone, intensely jointed. Open joints, halffilled with zeolithes. Low permeability.		340	100	60/38/18/12			
	342	Intensely jointed basalt, joints have mainly rough and undulating surfaces, coated with black clay.		342	100	15/0/0/0			
	344			344	100	0/0/0/0			
	346			346	100	19/0/0/0			
	348			348	100	58/27/0/0			
187	346	Sediment, claystone very weak, medium reddish brown, waxy core. Argillaceous pumice, probably swelling clay, joints with slickenside surfaces. Very poor tunneling rock.	K-37 K-38	346	100	0/0/0/0			
	348		UCS 10,3 MPa	348	100	0/0/0/0			
	350	Scoria - scoriaceous basalt weak to medium strong, reddish brown, voids in the upper part with sedimentary infiltrations.		350	100	39/0/0/0			
183	350			350	99	42/0/0/0			

8,9 LU
at
10 bar

does not open,
max. pressure
15 bar

Elev. m a.s.l.	Depth m	Description of corehole VK - 03	Depth	Rock column	Core %	RQD % 10/30/50/100	Q	GWT	Perm. (LU) 2,5 5,0 7,5
183	350	Scoriaceous basalt medium strong, dark grey, intense zeolithe fillings.	350						
181	352	Tholeiite and basaltic dyke strong - very strong, medium dark grey. Intensely jointed but most joints are cemented with black clay.	352		97	97/18/16/0			
	354	Microporous flow structure froms irregular and spectacular flow banding. The rock looks like a mix of dyke and basalt and consists technically of a highly jointed and fractured basalt.	354	K-38 K-39	100	57/0/0/0			
	356		356		100	51/22/0/0			
	358		358		100	17/0/0/0/0			
	360		360		100	40/40/0/0			
	362		362	K-39	99	63/22/5/0			
173	364	Basaltic dyke very strong, hard basalt, medium light grey with very small micropores, very fine grained. Frequent pattern of black veins of joints, 0,1 - 0,2 mm wide, healed with black clay.	364	K-40	100	29/0/0/0			
	366	Basaltic dyke or tholeiitic basalt, intensely tectonised basalt, black veins of clay filled and recemented joints (1 - 3 mm wide). Probably lower average tunneling rock.	366		97	57/38/0/0			
	368	Tholeiite very strong and hard, medium grey, scattered pores (< 10 mm) filled with black clay.	368		90	40/30/0/0			
168	370		370		100	63/0/0/0			
165	372	Sediment, claystone Weak to very weak, dark red and brownish red, waxy surface of core, Argillaceous swelling sediment, poor tunneling rock.	372	K-40 K-41	100	55/34/0/0			
163	374	Scoriaceous basalt - Tholeiite strong, medium grey, approximately 10 % vesicles (< 5 mm), filled with white zeolithes.	374		88	50/50/0/0			
	376	Unclear diffuse boundary. Tholeiite very strong, medium grey, hard and brittle basalt.	376		95	39/21/0/0			
	378		378		100	30/0/0/0			
	380		380	K-41 K-42	98	83/55/55/0			
	382	Unclear diffuse boundary. Scoriaceous basalt strong, 10 % vesicles, filled with zeolithes.	382		100	98/98/98/78			
	384	Tholeiite very strong, medium grey, fine grained basalt, hard and brittle.	384		100	98/98/85/0			
	386	Vesicles form zones with up to 7 - 10 % vesicles. Otherwise scattered vesicles (< 6mm) filled with black clay.	386		100	74/48/48/0			
	388		388		100	96/79/79/58			
	390	Unclear diffuse boundary. Scoriaceous basalt strong, grey - purple grey, very compact and consolidated, very competent tunneling rock.	390	K-42 K-43	99	5,4 - 18,0			
	392	2 - 5 % vesicles (< 7 mm) filled with black clay.	392		100	81/59/45/19			
	394	Tholeiite very hard and strong, medium grey, fine grained basalt.	394		98	95/78/62/0			
	396		396		100	72/59/30/0			
	398	Increasing joint frequency.	398	K-43 K-44					
141	400		400						

1 LU
at
15 bar

2 LU
at
15 bar

Empl. Greið leið

Coord. X: 544341,x

Y: 578243,x

Elev.: 231,x

Driller RFS

Drilled Nov. 2005

Elev. m a.s.l.	Depth m	Description of corehole VK - 04	Depth m	Rock column	Core %	RQD % 10 / 30 / 50 / 100	Q	GWT	Perm. (LU) 2,5 5,0 7,5
231,x	0	3" odex casing down to 9m depth. Inclination 58° (32° inclined from vertical), towards E.	0						
	2	NQ drilling rods, triple tube. Core diameter 45mm.	2						
	4	The hole is located approximately 50 m uphill from the old Vaðlaheidarvegur at the north side of a cultivated grass field.	4						
	6		6						
	8		8						
193,5		Sediment, claystone very weak, dark red-brown.			62	0/0/0/0			
	10	Scoria - scoriaceous basalt medium strong, dark reddish grey, approximately 10 % pores, mixed with sediment at the top.	10		97	66/20/20/0			
	12		12						
	14	The rock is rather competent in situ, but of medium low strength and breaks during drilling and handling.	14		75	39/25/25/0			
	16	diffuse boundary, rock of medium strength	16		100	40/0/0/0			
	16	Tholeiite very hard and strong, medium light grey, fine grained with frequent flow banding.	16		76	11/0/0/0			
	18	Intensely jointed and fractured from 16,5 - 19,5 m depth, tectonised zone. A high ratio of the joints is recemented with black clay and white zeolithes. The joint frequency decreased downwards.	18	(R)	100	0/0/0/0			
	20	Scattered thin veins of joints, healed with black clay. Brown alteration zones around open and healed joints.	20		89	0/0/0/0			
	22		22		100	0/23/0/0			
	24		24		100	56/56/0/0			
	26	Frequent joint pattern, often healed with black clay and white zeolithes.	26		100	37/14/0/0			
	28		28		100	36/33/0/0			
	30	Few open joints, half filled with zeolithes. Also scattered thin black veins of healed joints, some with brown alteration ones. The joints show rough and undulating surfaces, which are thinly coated with black clay.	30		95	41/11/5/0			
	32		32		100	52/23/0/0			
	34	Tectonised zone of 0,2 m, crushed and recemented rock.	34		100	$Q_c = \frac{41}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$			
	36	Sediment, silt-claystone Weak to very weak, red brown.	36		100	0/0/0/0			
	38	Scoriaceous basalt medium strong, reddish brown. 10 - 20 % vesicles (< 15mm), mainly filled with zeolithes. The core breaks up during drilling and handling	38	(R)	100	43/0/0/0			
	40	Sediment, sand-claystone very weak, red brown. The sediment breaks up during drilling, only small pieces are recovered.	40		100	49/0/0/0			
	42	Scoriaceous basalt medium strong, reddish grey, microporous. diffuse boundary	42	(R)	99	$Q_c = 3,3 - 10,9$			
	44	Tholeiite strong, hard, grey rock with a dense network of white joints, healed with zeolithes, tectonised rock. diffuse boundary	44	(R)	98	$Q_c = \frac{49}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$			
	46	Scoriaceous basalt moderately strong, dark grey, 5 - 15 % vesicles (< 20 mm), all filled with zeolithes.	46		96	80/58/21/0			
	48	Tholeiite 10 - 15 % large vesicles (< 20 mm), all filled with white zeolithes. Scattered pattern of white veins, joints healed with zeolithes. sharp, but well cemented boundary	48	(R)	99	$Q_c = 5,3 - 17,8$			
158,9	50	Sediment, claystone very weak, dark grey and dark red, waxy core. scoriaceous basalt	50		100	78/60/26/0			
					100	100/0/0/0			

does not open max. pressure 5,6 bar

**Vaðlaheiði
Corehole VK - 04 50 - 100 m**

Date Dec. 2005

Page 2 of 5

Design AgG

Drawn GG / AgG

Empl.

Greið leið

Coord. X: 544341,x

Y: 578243,x

Elev.: 231,x

Driller RFS

Drilled Nov. 2005

Elev. m a.s.l.	Depth m	Description of corehole VK - 04	Depth m	Rock column	Core %	RQD % 10 / 30 / 50 / 100	Q	GWT	Perm. (LU) 2,5 5,0 7,5
158,9	50	Scoriaceous basalt moderately strong, medium grey, compact and well consolidated rock. 10 - 15 % small, irregular vesicles, all filled with white zeolithes.	50		100	78/37/0/0			
	52	diffuse boundary Tholeiite very strong, light grey, scattered pattern of thin white veins of joints healed with white zeolithes. Less scoriaceous zones.	52		100	76/30/0/0			
	54		54				Qc = 0,6 - 2,2 $Qc = \frac{13}{12-15} \times \frac{2-4}{2-3} \times \frac{1}{1}$		
	56	Pink - grey scoriaceous basalt, strong rock.	56		100	72/39/0/0			
	58	Tholeiite intensely jointed, hard and brittle basalt, slightly tectonised zone. The joints show normally rough and undulating surfaces, which are coated with black clay. Hard and strong tholeiite basalt, microporous flow banding. Highly jointed, joints with rough and undulating surfaces, coated with black clay.	58		100	0/0/0/0			
	60		60		100	43/0/0/0			
	62	Additionally thin vein pattern of healed joints, indicating a former stress zone in the rock.	62	(N)	100	30/0/0/0			
	62		62		100	11/0/0/0			
	62		62		100	24/0/0/0			
	62		62		90	14/0/0/0			
146,6	64	0,2 m scoriaceous at the base	64		100	29/0/0/0			
	64	Sediment, siltstone weak to very weak, dark, almost black, waxy core.	64		36	0/0/0/0			
	64	Dyke	64		100	20/0/0/0			
	66	Sediment, siltstone very weak, black.	66		67	25/0/0/0			
	66	Dyke basaltic, very strong, medium grey, fine grained, 5 - 10 % micropores.	66						
	68	Scattered pattern of thin white veins of joints, healed with zeolithes.	68		85	38/0/0/0			
	70	Thin "layers" of microporous flow banding.	70		100	78/33/0/0			
	70	Scattered irregular pattern of white veins of joints, healed with zeolithes.	70		96	61/23/0/0			
	72		72	(N)			Qc = 4,1 - 13,6 $Qc = \frac{61}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$		
	72		72		97	70/37/0/0			
	74		74		100	61/23/0/0			
137,0	76	Tholeiite very hard and strong, medium grey.	76		100	48/36/0/0			
	76		76		47	23/0/0/0			
	78	Intensely jointed, tectonised zone. Small pieces of hard and grey basalt. Most stumps with thin black veins of joints, healed with black clay.	78	(N)	88	0/0/0/0	Qc = 1,1 - 4,0 $Qc = \frac{24}{12-15} \times \frac{2-4}{2-3} \times \frac{1}{1}$		
	78		78		86	0/0/0/0			
	78		78		87	37/0/0/0			
	80	The joints show rough and undulating surfaces which are coated with black clay.	80		100	0/0/0/0			
	80		80		90	0/0/0/0			
	80		80		100	60/0/0/0			
	82	Sediment, siltstone very weak, red and dark. Waxy argillaceous sediment with slicken sides on joints, erodes during drilling.	82		45	0/0/0/0			
	82	Scoriaceous basalt medium strong, purple grey, well compressed and consolidated. Possibly red sediment and core loss at 183m depth.	82		100	10/0/0/0			
	84	Probably massive rock in situ, but breaks into stumps during drilling and handling.	84		89	18/0/0/0			
	86	Scattered pattern of white veins, joints healed with zeolithes.	86		100	87/13/0/0			
	86		86				Qc = 3,4 - 11,3 $Qc = \frac{51}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$		
	88	Tholeiite hard and strong, medium grey basalt. The rock is tectonised, pattern of black and white veins of jointed rock, but recemented and healed with black clay and zeolithes.	88		100	60/0/0/0			
	90		90		100	45/36/0/0			
	90		90		95	51/14/0/0			
	92	The rock is fractured due to former stress, but totally recemented into a rock mass of medium strength.	92	(N)	100	65/27/0/0			
	94	Dark grey basalt with thin black veins of healed joints, indicating former stress.	94		70	27/0/0/0			
	94	core loss	94						
	96	Few veins of a dyke cut through the basalt. Velded contacts which are not reducing the strength of the rock mass considerably.	96		100	87/77/0/0			
	98		98		94	41/20/0/0			
	98	Pattern of thin, irregular, black veins formed by stress.	98		100	60/0/0/0			
116,5	100		100		100	44/0/0/0			

does not
open max.
pressure
5,6 bar

Elev. m a.s.l.	Depth m	Description of corehole VK - 04	Depth m	Rock column	Core %	RQD %	Q	GWT	Perm. (LU)
						10/30/50/100			2,5 5,0 7,5
116,5	100	Tholeiite	100		100	0/0/0/0			
		Sediment weak to very weak, dark grey, clayous siltstone			13	0,1 - 0,4			
		Crushed scoriaceous basalt, weak rock.			80	0/0/0/0			
	102	Fault zone	102		94	53/0/0/0			
		Basalt, crushed by tectonic but recemented with zeolithes.			100	0/0/0/0			
	104	The rock is is light grey due to some old thermal alteration. Highly tectonized rock, but recemented into medium strong to weak rock, which breaks up during drilling and handling. Rather poor tunneling rock.	104		94	39/0/0/0			
	106	Fault breccia. Base of higly tectonised zone.	106		93	45/35/0/0			
		Core loss and highly crumbled rock.			75	29/21/0/0			
	108	Tholeiite very strong, more competent rock.	108	K-11	62	22/0/0/0			
	110	Open joint and sudden loss of drilling water at 111 m depth.	110	K-12	100	75/0/0/0			
	112	Very hard and brittle basalt with a scattered network of very thin black veins healing some fractures in the rock. Brown alteration zones (3 - 5 mm wide) are following most of the thin joints.	112		100	55/22/0/0			
	114	Sudden loss of drilling water at 115 m depth. Intense pattern of white veins of joints healed with zeolithes. The rock shows clear marks of former intense stress, but is wel recemented and healed into medium strong rock.	114		97	51/0/0/0			
	116		116		100	54/20/0/0			
	118	Joints with rough and undulating surfaces, coated with black clay.	118	K-12 K-13	86	36/0/0/0			
	120		120		100	99/99/80/0			
	122	Sharp boundary between basalt and dyke, minor core loss at the boundary.	122		89	38/0/0/0			
97,6	122	Dyke basaltic, strong - very strong, medium grey, microporous.	122		100	79/55/0/0			
	124	Micropores filled with black clay. Competent tunneling rock.	124		96	33/0/0/0			
	126	< 3 % small plagioclase phenocrystals (< 4 mm).	126	K-13	100	66/40/0/0			
	128		128	K-14	98	56/0/0/0			
	130	Highly tectonised, frequent pattern of white veins of formerly open joints, but recemented and half filled with zeolithes. Still, many cavities are open and probably permeable.	130		100	50/38/0/0			
	132		132		100	20/0/0/0			
	134	Pyrite crystals (< 2 mm) are commonly seen.	134		95	43/13/0/0			
	136	Almost cube jointed rock of an basaltic dyke, intensely broken by former tectonic. The rock is over a great part recemented into massive rock with white 2 - 10 mm thick veins of joints, healed with zeolithes.	136	K-14 K-15	86	13/0/0/0			
	138	Practically similar conditions from 130 through to 150 m depth.	138		100	52/0/0/0			
	140		140		100	19/0/0/0			
	142	Probably secondary dyke intrusion in the main dyke. Crushed angular rock fragments, mainly recemented but breaks up during drilling and handling.	142		77	25/0/0/0			
	144	From here, the rock is probably mainly from tholeiitic basalt, dark grey pieces of highly jointed rock, frequent short zones (< 15 cm) of crushed but recemented rock.	144	K-15 K-16	83	0/0/0/0			
	146		146		78	0/0/0/0			
	148	Very strong rock pieces, dark grey, fine grained crystals.	148		95	45/31/0/0			
	150	Frequently open cavities in zeolithe filled vugs.	150		84	18/0/0/0			
74,1	150		150		100	14/0/0/0			
					100	23/0/0/0			
					100	43/32/0/0			

255 l/min with no pressure

Elev. m a.s.l.	Depth m	Description of corehole VK - 04	Depth	Rock column	Core %	RQD % 10 / 30 / 50 / 100	Q	GWT	Perm. (LU) 2.5 5.0 7.5
74,1	150	Tholeiite very strong, dark grey, fine grained rock. highly broken and tectonised rock.	150	(N)	100	14/20/0/0			350 l/min
	152		152	(N)	97	47/0/0/0			
	154	Few short zones with crushed rock and some minor core loss.	154	(N)	100	57/0/0/0			
	156	Scoriaceous tectonised zone.	156	(N)	95	70/0/0/0			
	158	Tholeiite very strong, medium grey, fine grained basalt.	158	(N)	100	55/0/0/0			
	160	Scattered white veins of joints, healed with white zeolithes. Three to four short (< 0,2m) zones of crushed rock.	160	(N)	97	45/13/5/0			
	162		162	(N)	100	62/19/0/0			
	164		164	(N)	100	Qc = 3,0 - 10,0			
	166	Tectonised basalt, open joints, half filled with zeolithes, clearly permeable zone.	166	(N)	100	Qc = $\frac{45}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$			
	168	Scoriaceous basalt strong, slightly reddish grey, 5- 10 % vesicles (< 10mm), all well filled with zeolithes.	168	(N)	100	18/0/0/0			
	170	Tholeiite very strong, light medium grey, vesicular in the upper part, 5 - 10 % vesicles (< 10 mm), well filled with zeolithes. Scattered plagioclase phenocrystals.	170	(N)	100	48/0/0/0			
	172	More massive basalt, scattered healed joints form white zeolithe filled veins.	172	(N)	75	23/0/0/0			
	174		174	(N)	100	53/0/0/0			
	176	Sediment, sandstone weak, dark red.	176	(N)	100	100/75/0/0			
51,5	178	Tholeiite very strong and hard, light grey at the top, medium grey in the middle and lower part, slightly microporous, fine grained basalt.	178	(N)	100	28/20/0/0			< 900 LU
	180	Hard and brittle basalt, joints with rough and undulating surfaces, cemented with black clay.	180	(N)	100	36/0/0/0			
	182	Few zones of crushed basalt.	182	(N)	100	68/12/0/0			
	184	Frequent inclined joints and white veins of thin healed joints. White zeolithes and thin black clay fillings heal most joints. Pyrite crystals (< 2 mm) at several locations.	184	(N)	100	71/39/17/0			
	186		186	(N)	100	Qc = 3,1 - 10,2			
	188	More massive zone at 185 - 192 m depth.	188	(A)	100	Qc = $\frac{46}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$			
	190		190	(A)	100	10/0/0/0			
	192	Few zones of crushed basalt.	192	(A)	100	39/0/0/0			
	194	velded contacts	194	(A)	100	57/0/0/0			
	196	Dyke intrusion, dark baslt veins, velded into the host rock.	196	(R)	99	31/0/0/0			
	198	Probably dyke basalt, very strong, dark grey, microporous, of similar strenght as the host rock.	198	(R)	100	68/42/13/0			
	200	The rock is highly jointed, but the joints are often healed with zeolithes and black clay.	200	(R)	31	6/0/0/0			
31,7	200	Basaltic dyke vein intrusion, very strong basalt.	200	(R)	100	92/0/0/0			equipment damaged Probably high flow

Vaðlaheiði Corehole VK - 05 0 - 45,1 m

Date Dec. 2005

Page 1 of 1

Design AgG

Drawn GG

Empl. Greið leið

Coord. X: 543530,3 Y: 577723,2 Elev.: 90,5

Driller RFS

Drilled Nov. 2005

Elev. m a.s.l.	Depth m	Description of corehole VK - 05	Depth m	Rock column	Core %	RQD % 10 / 30 / 50 / 100	Q	GWT	Perm. (LU) 2,5 5,0 7,5
90,5	0	3" steel casing down to 3,2m depth 30° inclined from vertical, towards W. NQ drilling rods, triple tube. Core diameter 45mm. The hole is located on a rock outcrop at the edge of a small grass field. Dyke swarm heading N-S visible at the surface. The coordinates were surveyed with hand held GPS tool, only to an accuracy of some 5 m.	0					29.11.2005	
	2		2						
87,8	4	Basaltic dyke strong, medium grey, medium grained basalt, highly jointed. Brown alteration zones (20 - 40 mm) around the joints. Brown clay coating on rough and undulating joint planes.	4		80 94	2830/0/0/0 0/0/0/0			
	6	Dyke contact, boundary of main dyke. Dyke vein, hard dark and brittle basalt.	6		73 86 100	22/0/0/0 8/0/0/0 13/0/0/0			
84,2	8	Tholeiite strong, medium grey. Intensely jointed and broken basalt, scattered small pores (< 5 %), filled with black clay.	8		100 50 94	0/0/0/0 0/0/0/0 0/0/0/0			
82,1	10	Sediment, Sandstone weak, very dark grey, sandstone mixed with scoria fragments.	10		93 95 100	0/0/0/0			
	12	Basaltic dyke very strong, medium grey, microporous. Frequently jointed, many joints are healed with white zeolithes forming thin white veins.	12		100 100 100	0/0/0/0 290/0/0/0 36/0/0/0			
	14		14		100	44/0/0/0			
76,1	16	well welded contact between dyke and basalt	16		100	53/0/0/0			
	18	Tholeiite very strong and hard, medium grey, medium grained basalt, < 5 % plagioclase phenocrystals. Frequently jointed, joints with rough and undulating surfaces, coated with black clay.	18		100 100 100	61/34/0/0 13/0/0/0 28/0/0/0			
	20		20		100	51/21/0/0			
	22	Thin dyke vein (5 cm), intensely crushed basalt at 23 - 24 m depth.	22		100	36/5/2/0 99 $Q_c = \frac{36}{9-10} \times \frac{2-3}{2-3} \times \frac{1}{1}$			
	24	Vesicular lower part of the basalt layer, approximately 10 % vesicles (< 10 mm), all well filled with zeolithes.	24		100	62/42/42/0 0/0/0/0			
68,4	26	Basaltic dyke very strong, medium grey, microporous. Highly jointed, joints with rough and undulating surfaces, coated with black clay.	26		100 100 100 90	14/0/0/0 0/0/0/0 0/0/0/0 0/0/0/0			
	28		28		100	25/0/0/0			
	30		30		96	16/0/0/0			
	32		32		100	70/0/0/0			
	34		34		100	83/0/0/0			
	36	Dark medium grey microporous basaltic dyke	36		100	36/0/0/0			
	38		38		89	0/0/0/0			
	40	Tectonised zone, basalt fragments recemented with white zeolithe. Fillings up to 20 cm wide. Frequently jointed basalt, joints with rough and undulating surfaces, coated with black clay. Some joints are well healed, forming thin black veins.	40		100 100	38/0/0/0 83/0/0/0			
54,1	42	Bottom at 42 m depth, 28. Nov. 2005	42		93 100	40/0/0/0 61/0/0/0			
	44		44						
	46		46						
	48		48						
	50		50						

PERMEABILITY NOT TESTED
No loss of drilling water, and obviously low permeability.

Vaðlaheiði east

Date Nov. 2010

Page 1 of 11

Empl. **Vegagerðin / Greið leið**

Corehole VK - 06 0 - 50 m

Design AgG

Drawn AgG

Coord. X: 547732

Y: 580502

Elev.: 479,5

Driller RFS

Drilled Oct. 2010

Elev. m a.s.l.	Depth m	Description of corehole VK - 06	Depth m	Rock column	Core %	RQD %	Q	GWT	Perm. (LU)
479,5	0	Surface, moraine with stones and boulders up to 0,8 m diameter The coordinates were surveyed by handheld GPS tool, only to an accuracy of some +/- 3 m. Elevation of the hole is based on 2m contour lines as shown on map	0						
	2		2						
	4	4" steel casing drilled down to 9m depth NQ drilling rods, triple tube. Core diameter 45mm The hole is drilled towards west (260), 45° inclined from vertical	4						
	6	Large stone, some 1,5 m thick on the top of bedrock, possibly frost lifted	6						
475		Surface of bedrock							
	8	Hard bedrock, slow percussion drilling, light grey dry dust	8						
473		Casing drilled to 9,15 m depth							
	10	Porphyritic basalt (olivine basalt type) medium grey, hard and very strong rock	10		47	100/0/0/0			
	12	Plag. phenocrystals, approx. 15-20% ≤ 6 mm Several joints, rough, undulating, coated with light pale brownish clay Vesicular basalt, 3-8% vesicles ≤ 10 mm coated and filled with zeolites	12	(R)	80	25/0/0/0			
	14		14		96	39/0/0/0			
	16	Scoritic, red brown, moderately strong rock Trace of red sediment, mixed with scoria at the base No weakness at the contact	16		76	49/16/0/0			
	18	Porphyritic basalt, medium grey, ca.10% plag.phen. ≤ 5 mm porous at top ca. 10% vesicles ≤ 10 mm, half filled with zeolites (Chabazite) Scattered, inclined joints	18	(R)	87	35/13/0/0			
	20		20		85	17/0/0/0			
465		Sediment, Claystone Sediment dark red at the top but light Core loss 0,9 m Red sediment. yellowish brown in the lower 0,5 m Very weak rock (partly extremely weak), waxy surface, breaks up during drilling and handling			10	0/0/0/0			
	22		22		36	0/0/0/0			
463					17	0/0/0/0			
	24	Intermediate Olivine - Porphyritic basalt Hard and strong basalt. Approx.10% small plag.phen. at the top Very hard and strong, vesicles up to 10 mm filled with zeolites.	24		38	0/0/0/0			
	26		26	(R)	45	0/0/0/0			
	28	Joints spacing 10-60 cm, joints rough undulating, some are healed with zeolites, yellow opal common on rough jointplanes (No obvious reason for core loss)	28		90	0/0/0/0			
	30	Tectonized basalt, the rock seems to break up and erode at matrix in joints	30	(R)					
	32		32						
	34	Tectonized basalt Joint gauges of well cemented clayous hard matrix and zeolites The rock breaks up and erodes due to drilling problem	34						
	36	Vesicular basalt, half filled and filled with zeolites, few joints cemented with zeolites	36						
	38		38						
452		Tectonic breccia Core stumps of porphyritic basalt mixed with hardened light brown sediment of tuff and red interbeds Possibly large throw at the fault plane	40		83	49/33/19/0			
	42	The matrix is possibly some 20% of the tectonic fault zone	42		72	50/38/38/0			
	44		44						
448		Sediment, claystone Red and light brown, waxy, very weak and extremely weak siltstone/claystone The rock crumbles and erodes during drilling	44						
	46		46						
446			48						
	48	Phorphyritic-olivine basalt, scoriaceous at top ca.0,5 m, hard and strong, frequently jointed, joints spacing 5-50 cm, joints rough, undulating, coated with brownish clay-opal	48						
444	50		50						

At 45 m hole depth

At 100 m hole depth

< 0,1 LU at 6,8 m

Vaðlaheiði east

Date Nov. 2010

Page 2 of 11

Empl. **Vegagerðin / Greið leið**

Corehole VK - 06 50 - 100 m

Design AgG

Drawn AgG

Coord. X: 547732

Y: 580502

Elev.: 479,5

Driller RFS

Drilled Oct. 2010

Elev. m a.s.l.	Depth m	Description of corehole VK - 06	Depth	Rock column	Core %	RQD % 10 / 30 / 50 / 100	Q	GWT	Perm. (LU) 2,5 5,0 7,5
444	50	Intermediate Olivine - Porphyritic basalt Porphyritic olivine basalt, scoriaceous competent basalt Tectonized rock, old joints recemented with zeolites and opal, no serious weakness detected in the former joint zones Vesicular scoriaceous basalt, all vesicles half filled or filled with zeolites Chabazite-thomsonite	50		100	61/42/18/0			
	52		52		100	57/10/0/0			
	54		54		97	60/26/10/0			
	56		56		100	64/36/15/0			
439	58	Olivine basalt with scattered plag.phen. The rock is tectonized, with formerly crushed but recemented zones The cement material is mainly black clay Problem with inner drilling rod, the core breaks up and erodes	58		97	0/0/0/0			
	60		60		53	15/0/0/0			
	62		62		35	16/0/0/0			
	64		64		71	21/0/0/0			
	66		66		100	43/0/0/0			
	68		68		83	0/0/0/0			
	70		70		96	28/0/0/0			
430	72	Sediment, claystone light orange red, very weak rock, waxy surface of core, pebbly granules ≤ 5 mm near the base	72		100	74/0/0/0			
	74		74		100	19/0/0/0			
	76		76		100	0/0/0/0			
	78		78		100	77/0/0/0			
	80		80		100	67/62/0/0			
	82		82		100	46/0/0/0			
	84		84		100	59/0/0/0			
	86		86		100	43/5/0/0			
	88		88		100	26/0/0/0			
416	90	Sediment, siltstone claystone Red at top but brown in the lower part Waxy, very weak rock, crumbles and erodes during drilling	90		30	0/0/0/0			
414	92	Porphyritic basalt Erodes during drilling problems, also tectonic breccia	92		21	0/0/0/0			
413	94	Sediment, claystone Yellowish brown, extremely weak rock that erodes and crumbles during drilling Waxy surface on particles, like oily surface	94		19	0/0/0/0			
	96		96		85	0/0/0/0			
	98		98		89	0/0/0/0			
408,8	100	Fault breccia Medium grey and black, small fragments of angular basalt Core erodes slightly. pieces, well cemented with clay, fair tunnelling rock	100		0	0/0/0/0			
					42	0/0/0/0			
					100	53/0/0/0			
					100	0/0/0/0			

< 1,5 LU at 7,1 bar

At 150 m hole depth

At 200 m hole depth

0 LU up to 9 bar Starts to bleed at 10-12 bar < 0,5 LU at 12,5 bar

At 330 m hole depth

At 350 m to end of drilling hole

Elev. m a.s.l.	Depth m	Description of corehole VK - 06	Depth	Rock column	Core %	RQD % 10 / 30 / 50 / 100	Q	GWT	Perm. (LU) 2,5 5,0 7,5
409	100	Dyke Basalt, dark grey and almost black	100		100	53/0/0/0			
		Sediment - claystone Red, weak, waxy surface on core			86	23/0/0/0			
407	102	Olivine basalt scoriaceous with minor sediment fillings, sediment very weak and erodes	102		89	41/0/0/0			
		Fault breccia well cemented fragments of basalt yield cemented rock			100	79/0/0/0			
	104	Olivine basalt - Basaltic dyke medium dark grey, relatively coarse grained basalt with flow structures	104		100	76/76/50/0			
	106	Crystalsize resembles dolerite Moderately to highly jointed	106		100	68/26/0/0			
	108	Joint spacing mainly 0,1-0,5 m, joints rough, undulating coated with dark clay	108		100	51/13/0/0			
	110		110		100	70/30/0/0			
	112	The rock is darkgrey, as a result of black clay filling all pores and joint planes Micropore flow banding in addition to other micropores	112		100	45/45/30/0			
	114		114		97	59/29/10/0			
	116	Scattered large vesicles filled with black clay or zeolites	116			Qc = 3,9 - 13 $Qc = \frac{59}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$			
	118	Medium joint spacing, all joints rough, undulating, filled with black stiff clay	118		100	70/31/0/0			
	120		120		100	15/0/0/0			
	122		122		100	43/0/0/0			
	124		124		100	96/79/25/0			
	126	Dyke. Well cemented contact	126		100	39/0/0/0			
390	126	Scoriaceous basalt Scoriaceous and tectonized basalt	126		100	40/0/0/0			
	128	Sediment, claystone Light red to red veak, waxy with slicken sides Very weak to extremely weak rock, crumbles and erodes slightly	128		91	83/0/0/0			
		Orange red to light brown tuffaceous, clayous sediment, very-extremely weak			82	27/0/0/0			
	130	Grey tuffaceous claystone, very weak Light brown tephra rich claystone	130		58	0/0/0/0			
	132	Medium grey claystone rich of tehpra, waxy surface, very weak rock Inclination of hole 44,2° below horizontal Probably no original joints	132		98	30/0/0/0			
	134	Dark grey-black claystone, weak rock, but stronger part of the sediment	134		85	42/15/10/0			
	136	Probably few or no original joints in the sediment	136			Qc = 0,2 - 2 $Qc = \frac{42}{6-9} \times \frac{1-2}{3-4} \times \frac{1}{2,5-5}$			
	138	Light grey zone, claystone - very weak	138		100	66/12/0/0			
381	140	Scoria - Scoriaceous basalt Scoria mixed with sediments Medium strong scoriaceous basalt with approx.15-20% of clayous sediment infiltration, decreasing downwards	140		100	87/45/0/0			
	142	A mix of scoriaceous basalt and tectonic breccia, medium strong, competent rock	142		100	95/74/74/0			
	144	Tholeiite basalt Medium grey, hard and strong, vesicular in the upper half, 5-10% vesicles ≤ 20 mm. Moderately jointed, joints rough, undulating, coated with dark and green clay	144		100	96/59/37/0			
	146		146		100	79/45/20/0			
	148	Probably a fault zone, 0,2 m green clayous sediment with basalt fragments	148		100	75/41/19/0			
373	150	Scoriaceous basalt	150		100	87/62/0/0			

0 LU tested up to 17 bar

0 LU tested up to 14 bar

Elev. m a.s.l.	Depth m	Description of corehole VK - 06	Depth	Rock column	Core %	RQD % 10 / 30 / 50 / 100	Q	GWT	Perm. (LU) 2,5 5,0 7,5
373	150	Scoriaceous basalt with sediment on voids at the base, 40 cm zone Sediment Red claystone, waxy, very weak, mixed with scoria in lower part	150		92	62/34/0/0			
					94	0/0/0/0	22/0/0/0		
	152	Scoriaceous basalt Greyish brown, strong sediment infiltration in the upper part but compact in the lower part Competent rock	152		100	96/81/76/76			
	154	Porphyritic basalt - Tholeiite basalt Medium grey, with vesicular and flow banded zones	154	(R)	100	100/0/0/0			
	156	Frequent thin micropore bands	156		100	81/53/18/0			
	158		158		100	80/46/21/0			
	160	Inclination of hole 44,3° below horizontal The basalt is with 5-10% plagioclas phenocrystals in the upper part but the phenocrystals decrease downwards	160		100	85/85/46/46			
	162	Tholeiite basalt Light grey, very hard and strong rock	162				Qc = 5,1 - 17,3 $Qc = \frac{78}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$		
	164	Frequent thin micropore flow banding	164	(R)	100	78/50/33/12			
	166		166		100	72/38/23/0			
	168		168		100	80/35/17/0			
	170		170	(R)	100	100/41/41/0			
	172		172		100	58/29/29/0			
	174		174		100	100/90/90/0			
	176	Scoriaceous basalt, dark red brown Sediment, red sandstone 15 cm	176		100	0/0/0/0			
355	176		176		100	45/0/0/0			
	178	Scoriaceous basalt Redbrown, well compressed, moderately strong and strong, brittle rock	178		100	42/42/0/0			
	180	Tholeiite basalt Light grey, very hard and strong rock Partly with micropore flow banding	180	(R)	100	61/38/0/0			
	182	Moderately jointed Highly jointed	182		100	87/57/0/0			
	184	Joints rough, undulating, coated with black and green clay and occasionally with small chabazite zeolite crystals	184		100	59/16/0/0			
	186		186		100	38/0/0/0			
	188		188	(R)	100	0/0/0/0			
346	188	Sediment, silt - claystone dark reddbrown, siltst. waxy, weak rock	188		64	43/0/0/0			
	190	Scoriaceous basalt vesicles mainly filled with green clay	190		93	14/0/0/0			
	192	Basaltic dyke brecciated dark grey microporous rock, probably there is a tectonic fault zone along the dyke, brecciated recemented basalt Inclination of hole 44,9° below horizontal	192		83	0/0/0/0			
	194	Dark grey porous dyke, tectonized rock	194		100	60/14/0/0			
	196	Composite dyke, difficult to define where dyke ends and basalt starts	196		95	46/13/0/0			
	198	Tholeiite basalt light grey, fresh, very hard and strong Joints rough, undulating, coated with black clay	198	(N)	100	29/14/0/0			
342	196		196		89	0/0/0/0			
	200		200		100	88/0/0/0			
338	200		200		100	75/25/0/0			
					100	81/46/0/0			
					100	60/49/23/0			
					100	70/45/14/0			

0 LU tested up to 14 bar

< 2 LU tested up to 15 bar

**Vaðlaheiði east
 Corehole VK - 06 200 - 250 m**

Date Nov. 2010

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Empl. **Vegagerðin /
 Greið leið**

Design AgG

Drawn AgG

Coord. X: 547732

Y: 580502

Elev.: 479,5

Driller RFS

Drilled Oct. 2010

Elev. m a.s.l.	Depth m	Description of corehole VK - 06	Depth	Rock column	Core %	RQD % 10 / 30 / 50 / 100	Q	GWT	Perm. (LU)		
									2,5	5,0	7,5
338	200	Tholeiite basalt Hard and strong, light grey core, very hard and brittle rock	200		100	Qc = 4,7 - 15,6 $Qc = \frac{70}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$					
	202	Frequently jointed, joints rough, undulating, coated with black clay	202		100	76/53/37/37					
	204	Vesicular zones	204		100	67/43/0/0					
	206	Very vesicular basalt, most vesicles empty and coated with black clay	206								
333	208	Sediment, claystone Red siltstone-claystone, waxy surface, very weak rock Probably no original joints	208		100	100/100/0/0					
	210	Yellowish brown and green in the lower part	210		100	61/29/0/0 Qc = 0,7 - 3 $Qc = \frac{67}{6-9} \times \frac{1-2}{3-4} \times \frac{1}{2,5}$					
	212	Scoria - scoriaceous basalt Dark grey, moderately strong, well compressed and consolidated, very vesicular rock. Most vesicles filled with white zeolites	212		100	98/0/0/0					
	214	Vesicular down to 217 m depth	214		100	97/97/97/75 Qc = 7 - 23 $Qc = \frac{99}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$					
	216	Scoria - scoriaceous basalt, porphyritic type	216		100	100/82/82/82					
	218	Porphyritic basalt Light grey, ca.5-7% plag.phenocrystals ≤ 4 mm, hard and strong Vesicles disappear downward, hard and strong basalt, slightly tectonized but well cemented at 220 m depth Inclination of hole 45,2° below horizontal	218		100	65/11/0/0					
	222	Porphyritic basalt - like tholeiite basalt, light grey, hard and strong rock Micropore flow bandings Highly jointed, possibly tectonized rock, joints rough, undulating	222		100	272/212/212/0					
	224		224		100	67/0/0/0 88/76/52/0 Qc = 5,3 - 17,6 $Qc = \frac{79}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$					
	226		226		92	52/0/0/0					
	228		228		100	16/0/0/0					
	230	Drilling problem. Inner rod not in right place	230		100	76/27/0/0					
	232		232		100	68/27/0/0					
315		Sediment - sandstone Light red, not waxy, moderately strong			100	100/0/0/0					
	234	Scoriaceous basalt Redbrown, well compressed and consolidated, moderately strong rock	234		100	97/97/97/97					
	236	Tectonized zone 0,3 m at 237,8 - 238,1	236		100	100/100/100/76 Qc = 7 - 23 $Qc = \frac{99}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$					
	238	Tholeiite basalt Tholeiite basalt, light grey, very hard and strong rock Porous and vesicular, most vesicles half filled or filled with white hard clay and zeolites Open void ca. 10 cm, chabazite crystals	238		98	89/77/41/0					
	242	Open void ca. 5 cm, chabazite crystals	242		97	83/63/41/10 72/58/22/0 Qc = 5,3 - 18,5 $Qc = \frac{83}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$					
	244		244		95	72/58/22/0					
	248	Inclination of hole 45,7° below horizontal Tectonized (brecciated) rock ca.0,3 m, well cemented	248		99	84/38/25/0					
303	250	Scoria zone 10-15 cm at the base Sediment - sandstone	250		100	61/0/0/0					

< 0,5 LU tested up to 20 bar

Elev. m a.s.l.	Depth m	Description of corehole VK - 06	Depth	Rock column	Core %	RQD % 10 / 30 / 50 / 100	Q	GWT	Perm. (LU)		
									2,5	5,0	7,5
303	250	Sediment, claystone Red siltstone - claystone, weak to very weak rock, waxy surface Turns to green and gradually changes to sandstone	250		100	84/84/84/0					
	252	Sediment - sandstone	252		100	79/33/33/0					
	254	Sandstone, dark green, medium grained, stratified, thinly bedded, beds 2-10 mm thick, medium strong rock Few original joints	254	K-25 K-26	100	99/99/99/99					
	256	White vein, joints filled with calsite, 3-5 mm aperture	256		100	98/98/98/69					
	258	Several white veins, joints healed with calsite, aperture 15-25 mm	258		100	95/91/91/79					
	260	Dark green-grey uniform, medium to fine grained sandstone	260		100	91/91/91/91					
	262	The sediment is more coarse grained in the lower part Several thin white veins (up to 15 mm) of calsite healing, former joints	262	10 5,6 kN 36 MPa	100	100/100/100/100					
	264	Coarse grained sandstone with small pebbles	264	K-26 K-27	100	100/100/100/100					
	266	Medium strong rock	266		100	100/100/100/100					
	268		268		100	97/91/91/91					
	270	Inclination of hole 46,1° below horizontal	270	8 5,3 kN 35 MPa	100	97/97/97/97					
	272	Coarse grained sandstone-almost fine grained conglomerate with sandy matrix	272	K-27 K-28	100	65/41/0/0					
	274	Scoriaceous basalt with sediment fillings in large voids at the top, well compressed, medium strong rock	274		100	99/83/27/0					
	276	Porphyritic basalt	276		100	100/100/0/0					
	278	Porphyritic basalt, light grey, hard and strong, 5-7% small plag.phenocrystals, vesicular, mostly filled with zeolites and black clay	278		100	95/95/77/0					
280	Scattered white veins of joints healed with zeolites Inclination of hole 46,1° below horizontal	280		100	90/87/74/47						
282	Tectonized basalt, former joints and crushed rock recemented with zeolites and black clay, water loss at 282,5 m depth	282	K-28 K-29	100	89/77/42/13						
284	The basalt is very hard and strong, brittle rock with close spaced joint system, some kind of a tectonic pattern	284		100	98/91/66/45						
286		286		100	93/90/52/0						
288		288		100	71/33/0/0						
290	Thinly micropore flowbanded in the lower part	290	11 21,4 kN 182 MPa	100	81/60/0/0						
292		292	K-29 K-30	100	54/54/0/0						
294	Sediment, sandstone - claystone red waxy, weak to very weak rock	294		100	100/100/100/100						
296	Scoriaceous olivine basalt Scoriaceous basalt, redbrown, highly vesicular ca 30-40% vesicles, filled with white zeolites	296	11 7,7 kN 50 MPa	100	95/88/75/38						
298	Porphyritic basalt Medium grey, hard and strong, plag.phenocrystals ca.15-20%, rather small (size < 5 mm)	298		100	92/76/63/63						
267	300	Several very large vesicles ≤ 50 mm half filled with zeolites	300		100	92/76/63/63					

15 LU tested up to 6,8 bar at 360 l/min! Maximum capacity of instruments

Open joint Probably > 360 l/min leakage there

$$Q_c = < 1 - 4$$

$$Q_c = \frac{95}{6-10} \times \frac{1-2}{3-4} \times \frac{1}{2,5}$$

$$Q_c = 5,9 - 30$$

$$Q_c = \frac{89}{6-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$$

$$Q_c = 6,5 - 21,7$$

$$Q_c = \frac{95}{6-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$$

Vaðlaheiði east

Date Nov. 2010 Page 7 of 11

Empl. **Vegagerðin / Greið leið**

Corehole VK - 06 300 - 350 m

Design AgG Drawn AgG

Coord. X: 547732 Y: 580502 Elev.: 479,5

Driller RFS Drilled Oct. 2010

Elev. m a.s.l.	Depth m	Description of corehole VK - 06	Depth	Rock column	Core %	RQD % 10 / 30 / 50 / 100	Q	GWT	Perm. (LU) 2.5 5.0 7.5
267	300	Porphyritic basalt medium grey, very strong rock Scattered vesicles 2-3% up to 10 mm filled with black clay Inclination of hole 46,3° below horizontal	300	(R)	100	85/82/82/0			
	302		302						
	304	Scoriaceous porphyritic basalt Scoriaceous basalt, porphyritic, well compressed, consolidated, medium strong-strong rock, very few joints - competent rock	304		100	98/89/65/0			
	306		306						
	308		308		100	95/88/75/38			
	310	Inclination of hole 46,4° below horizontal Approximately 1 m block of porphyritic basalt inside the scoriaceous basalt	310	(R)	100	94/90/58/36			
	312		312		100	97/87/87/50			
	314	Sharp contact, no weakness	314	(R)	100	98/98/67/0			
258	314	Sediment, Claystone Sediment, claystone, very weak to extremely weak rock, waxy surface	314		88	27/0/0/0			
	316	Dark reddish brown at the top, orange-red in the middle and lower part	316		94	77/61/38/0			
	318	Brown very weak claystone in the lowest part	318		95	51/37/20/0			
253	320	Scoriaceous olivine basalt sediment, infiltr. in the uppermost 0,6 m Medium dark grey, well compressed and consolidated	320		100	79/67/47/0			
	322	Olivine basalt Grey, strong rock, vesicular ca. 10-20% large vesicles down to ca. 325 m depth	322	(R)	97	64/34/0/0			
	324		324		99	72/41/27/0			
	326	Vesicles coated with black clay and light blue hard clay	326		100	85/50/50/0			
	328	Nice zeolites in voids	328		100	63/41/26/0			
	330	Inclination of hole 46,7° below horizontal Frequent joints, rough, undulating, coated with black and blueish hard clay	330	(R)	100	54/0/0/0			
245	332	Sediment, claystone Red siltstone-claystone, red in topmost 0,7 m then green-grey, waxy, very weak sediment	332		100	72/61/27/0			
	334		334		100	98/91/61/40			
	336	Sediment, sandstone Dark green, mainly fine grained well cemented, moderately strong sandstone, not waxy, the strongest part of the sediment	336		100	99/87/61/0			
	338	The core breaks up into scales during drilling, probably as a result of too high pressure	338		100	89/89/89/89			
	340	Stratified sandy and silty sandstone - claystone The strength is decreasing downwards	340		100	89/89/89/89			
	342	Greenish grey tuffaceous claystone, very weak, waxy surface The core breaks up into 3-10 cm long stumps	342		99	72/41/28/17			
	344	Inclination of hole 46,7° below horizontal	344		100	75/50/0/0			
	346	Sediment, claystone Greenish grey claystone, very weak to extremely weak, waxy surface on core	346		100	100/100/100/0			
	348		348		100	50/0/0/0			
232	350		350		100	75/0/0/0			

< 0,5 LU tested up to 19 bar
No flow below 8 bar

< 0,2 LU tested up to 20 bar
Opens at 22 bar
No flow below 8 bar

Elev. m a.s.l.	Depth m	Description of corehole VK - 06	Depth	Rock column	Core %	RQD %			Q	GWT	Perm. (LU)		
						10 / 30 / 50 / 100	2,5	5,0			7,5		
232	350	Sediment, siltstone - claystone Sediment claystone, very weak Waxy sediment, stratified dark green, reddish brown tephra layers altered to claystone	350	K-35 K-36	84	60/0/0/0							
	352	Probably no original joint	352		100	57/0/0/0							
	354	The core breaks up into scales during handling Very weak sedimentary rock	354		99	72/41/28/17							
	356		356			Qc = 0,8 - 3,2 $Qc = \frac{72}{6-9} \times \frac{1-2}{3-4} \times \frac{1}{2,5}$							
	358	"Soft" ductile sediment, molded with the drilling rods Inclination of hole 46,6° below horizontal	358		100	45/0/0/0							
	360	Sandstone, dark grey and green, stratified sandy and silty beds, not waxy, moderately weak, the strongest part of the sediment	360		K-36 K-37	100	94/94/61/61						
	362	Probably no original joint UCS 19,1 MPa	362		100	100/69/69/42							
	364	Stratified colourful green, grey and brown sediment Soft" ductile sediment, shrinks during drying	364			100	67/22/0/0						
	366	Green-grey claystone, weak to very weak weak rock UCS 14,2 MPa	366			98	27/0/0/0						
220	368	Scoriaceous basalt Scoriaceous basalt, dark grey, very porous and vesicular, moderately strong (competent tunnelling rock)	368		K-37 K-38	100	100/100/100/100						
	370	Scoriaceous basalt - Tholeiite 10 3,6 kN 20 MPa	370	100		84/75/75/56 $Qc = \frac{84}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$							
	372	Tholeiite basalt Tholeiite basalt, medium grey core, very hard and strong, slightly micropore flow banding. Joints rough undulating, coated with black and green hard clay	372	100		63/41/41/0							
	374		374	100		77/68/43/0							
	376		376	100		87/74/74/0							
	378	Tholeiite basalt, light grey, hard and strong, moderately to highly jointed, joints rough undulating, coated with black and blueish clay	378	100		72/44/30/10							
	380	Commonly brown alteration zone at the joints	380	K-38 K-39		100	Qc = 4,7 - 16 $Qc = \frac{72}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$						
	382		382	100		55/13/0/0							
	384		384	100		41/0/0/0							
	386		386	100		76/22/0/0							
205	388	Vesicular basalt in the lowest 0,3-0,5 m, sharp contact to sediment	388	K-39 K-40	100	82/77/53/53							
	388	Sediment, sandstone, very dark brown UCS 24,3 MPa	388		100	62/44/44/0							
	390	Sediment, claystone Claystone, red-dark red, extremely weak, breaks up and crumbles during drilling Red and dark red very weak and extremely weak rock, crumbles during drilling and handling. Very colourful stratified sediment UCS 7,2 MPa	390		100	0/0/0/0							
	392	Inclination of hole 47,2° below horizontal Green coarse grained pumice 0,2 m Probably few or even no original joints in the sediment Very weak to extremely weak rock	392		100	29/14/0/0							
	394	Green coarse grained pumice ≤ 0,4 m Very weak to extremely weak rock	394		99	20/10/6/0							
	396	Claystone, extremely weak, waxy, crumbles and deforms during drilling	396		Qc = << 0,1 - 0,8 $Qc = \frac{20}{6-10} \times \frac{1-2}{3-4} \times \frac{1}{2,5-5}$								
	398	Scoriaceous basalt Scoriaceous basalt, dark brown, highly vesicular, almost all vugs filled with zeolites	398		100	8/0/0/0							
	398	Tholeiite basalt	398		100	0/0/0/0							
	400	Tholeiite basalt, medium grey, very hard and strong	400		99	95/88/72/62							

<0,2 LU tested up to 20 bar
Opens at 22 bar
No flow below 8 bar

Elev. m a.s.l.	Depth m	Description of corehole VK - 06	Depth	Rock column	Core %	RQD % 10 / 30 / 50 / 100	Q	GWT	Perm. (LU)			
									2.5	5.0	7.5	
197	400	Tholeiite basalt Tholeiite basalt, light grey, very hard and strong, vesicular, large vesicles ≤ 10 mm, partly filled with zeolites	K-40 K-41	400	100	95/85/71/42						
	402			402	99	95/88/72/62						
	404		11 18,5 kN 157 MPa	404								
	406		UCS 8 MPa	406	99	91/85/50/50						
193	406	Sediment, siltstone - claystone Red sandstone at top, claystone most part Very weak, waxy core. Strong red colour, very weak (extremely weak) breaks up		406	100	46/30/0/0						
	408	Scoriaceous basalt Scoriaceous basalt, dark grey with sediment fillings in all voids in the upper part. Well compressed and consolidated, moderately strong rock, very few joints	11 2,2 kN 12 MPa	408	100	89/89/89/89						
	410		K-41 K-42	410	100	99/99/99/99						
	412			412	100	99/99/99/99						
	414	Tholeiite basalt Tholeiite basalt, light grey, very hard and strong intact rock, moderately jointed		414	98	81/51/51/0						
	416		K-42 K-43	416	100	85/51/22/0						
	418	Brown rusty colour is frequently in the rock around the joints		418	100	91/66/39/0						
	420	Most often thin black clay on the joint planes Inclination of hole 47,5° below horizontal		420	100	89/61/41/0						
	422			422	100	79/77/53/0						
	424	Open joint ca. 30 mm wide, almost filled with zeolites		424	100	96/55/41/0						
	426	Joints rough, undulating, coated with black clay and some wider joints are filled with zeolites	K-43 K-44 9	426	100	100/60/48/0						
	428	Tholeiite basalt, very hard and strong brittle basalt	20,6 kN 175 MPa	428	100	62/62/0/0						
176	430	Scoriaceous basalt, dark brownish grey, moderately strong sediment Sediment, sandstone sandstone, light red, moderately weak		430	100	100/100/100/0						
	432	Scoriaceous basalt Scoriaceous basalt, dark brown, porous, all vesicles and vugs filled with zeolites		432	93	78/78/67/46						
	434	Intermediate Tholeiite - olivine basalt Olivine-tholeiite, intermediate basalt (difficult to classify) Vesicles 2-5% mostly filled with zeolites		434	100	95/87/65/40						
172	436	Sediment, siltstone Sediment, dark sandstone 15 cm moderately weak		436	100	100/100/100/0						
	436	Scoriaceous basalt Scoriaceous basalt, highly porous and vesicular, all vesicles filled with zeolites	10 3,2 kN 18 MPa	436	100	99/99/99/99						
	438	Olivine basalt Olivine basalt, dark grey, microporous medium coarse grained Vesicular in the upper part, microporous in the lower part	7 16,7 kN 142 MPa	438	100	95/88/88/64						
	440			440	100	100/100/100/100						
	442	Scoriaceous olivine basalt Scoriaceous olivine basalt, dark grey, porous Very competent tunnelling rock		442	100	71/50/50/0						
	444			444	100	95/95/95/62						
166	444	Sediment, siltstone - claystone red claystone, dark at the top 0,2 m Very weak, waxy surface on the core, breaks up during handling dark at base 0,1 m		444	100	15/0/0/0						
	446	Scoriaceous basalt Scoriaceous basalt, dark grey, very porous All vesicles and vugs well filled with zeolites	K-45 K-46 10 1,6 kN 8 MPa	446	100	96/88/88/66						
	448	Tholeiite basalt Tholeiite basalt, medium grey, very hard and strong, vesicular, vesicles in the upper part filled with zeolites, empty in the lower part		448	100	94/94/0/0						
161	450			450	100	87/75/55/21						

0 LU tested up to 24 bar

Empl. **Vegagerðin / Greið leið**

**Vaðlaheiði east
 Corehole VK - 06 450 - 500 m**

Date Nov. 2010 Page 10 of 11

Design AgG Drawn AgG

Coord. X: 547732 Y: 580502 Elev.: 479,5

Driller RFS Drilled Oct. 2010

Elev. m.a.s.l.	Depth m	Description of corehole VK - 06	Depth m	Rock column	Core %	RQD %	Q	GWT	Perm. (LU)
						10 / 30 / 50 / 100			25 50 75
161	450	Tholeiite basalt Inclination of hole 47,8° below horizontal Scoria at base 0,2 m	450	(R)	100	84/71/71/0			
160	452	Sediment, sandstone Sediment, dark red sandstone 0,25 m Scoriaceous basalt Scoriaceous basalt, very porous with zeolites	452		100	80/59/0/0			
	454	Tholeiite basalt Tholeiite basalt, hard and strong, medium-light grey core K-46	454	(R)	100	82/32/20/0			
	456	Very vesicular in the upper part, large vesicles ≤ 30 mm 5-20% filled with scolesite zeolites K-47	456		100	76/43/24/0			
	458		458			Qc = 5,1 - 17,1 $Qc = \frac{76}{9 \cdot 10^x} \times \frac{2-4}{2-3} \times \frac{1}{1}$			
	460	Damaged core, the core is broken up as it slipped out of the inner rods at the retrieval	460	(R)	100	71/57/33/0			
	462		462		93	67/15/0/0			
	464		464		100	75/57/26/0			
	466	Scoriaceous basalt Scoriaceous basalt, dark grey-brown, very well compressed and consolidated, porous, all pores filled with zeolites K-48	466		100	100/100/100/60			
	468	Tholeiite basalt Tholeiite basalt, medium-dark grey core, very hard and brittle strong intact rock but highly jointed. Joints rough undulating, coated with black clay	468	(R)	100	63/0/0/0			
	470		470		100	71/15/0/0			
	472		472		100	54/21/0/0			
	474	Scoriaceous basalt at base 0,2 m Red sandstone 0,25 m, weak, crumbles K-48	474	(R)	100	31/21/0/0			
144	476	Scoriaceous tholeiite basalt A mix of scoriaceous basalt and tholeiite basalt, variable rock, porous, moderately strong rock K-49	476	(R)	100	89/65/0/0			
	478		478		100	0/0/0/0			
	480	Sediment, 0,3-0,4 m dark siltstone, probably an inclusion in the scoriaceous basalt Inclination of hole 48,3° below horizontal Scoriaceous tholeiite basalt Scoriaceous basalt, dark grey brown, vesicular ca.10-15% vesicles half filled with zeolites K-49	480		100	63/13/0/0			
	482	Sediment 0,3 m claystone, very dark red and black, three zones of 0,2-0,3 m claystone, mixed with the scoria K-49	482		100	74/39/18/0			
	484	Scoriaceous basalt Scoriaceous basalt, dark grey-brown, very well compressed and consolidated, porous, all pores filled with zeolites K-50	484		100	77/47/0/0			
	486		486		100	0/0/0/0			
135	488	Basaltic dyke Basaltic dyke, dark grey core, microporous very strong intact rock, joint spacing mainly 0,1-0,5 m, joints rough, undulating, coated with black and dark green clay K-51	488	(R)	100	97/86/59/42			
	490		490		100	94/39/18/0			
	492		492		100	84/47/0/0			
	494		494		100	79/79/49/0			
	496		496		100	0/0/0/0			
	498		498		100	84/47/0/0			
126	500		500	(R)	100	51/0/0/0			
					94	82/44/44/0			
					94	67/42/21/0			
					90	80/65/16/0			
					86	49/45/0/0			
					100	60/51/45/0			

1,5 LU tested up to 16,7 bar

Elev. m a.s.l.	Depth m	Description of corehole VK - 06	Depth	Rock column	Core %	RQD % 10 / 30 / 50 / 100	Q	GWT	Perm. (LU) 25 50 75
126	500	Basaltic dyke	500		100	60/51/45/0			
	502	Scoriaceous basalt	502		95	95/0/0/0			
	504	Tectonized near the contact Tectonized rock near the margin	504		100	93/90/60/38			
	506	Tholeiite basalt Scoriaceous basalt, grey-brown, well compressed and consolidated, moderately strong rock	506		100	92/90/52/33			
	508	Tholeiite basalt, light grey, very-extremely hard and strong, moderately to highly jointed, joints rough, undulating, coated with hard black clay, faint micropore flow banding	508		95	95/95/0/0			
	510	Inclination of hole 48,5° below horizontal	510		100	75/19/19/0			
	512		512		100	89/89/89/0			
	514		514		100	95/65/65/0			
	516		516		100	55/0/0/0			
	518	Highly jointed and almost crushed basalt	518		100	0/0/0/0			
	520		520		100	0/0/0/0			
	522		522		100	50/0/0/0			
109	524	Sediment, siltstone - claystone Sediment claystone, very weak, light red orange in the topmost 0,8 m then extremely weak tuffaceous claystone	524		99	99/99/99/0			
	526	Very dark red brown claystone, very weak, breaks up during drilling Green tuffaceous zone 0,45 m Green tuffaceous zone 0,3 m	526		87	44/12/0/0			
	528	Dark red brown claystone, extremely weak, crumbles down during drilling and handling	528		91	35/16/10/0			
	530	Extremely weak rock	530		94	6/0/0/0			
104	532	Scoriaceous basalt	532		100	22/0/0/0			
	534		534		100	97/89/51/34			
	536		536		100	97/88/72/53			
	538	Coreloss	538		100	93/83/83/37			
	540	Inclination of hole 48,7° below horizontal	540		100	99/99/99/99			
97	542	Tholeiite basalt Tholeiite basalt, light grey core, very hard and brittle, extremely high intact strength but heavily jointed.	542		100	58/13/0/0			
	544	Joints rough, undulating, coated with black glassy hard clay	544		100	13/0/0/0			
	546	Intensively jointed tectonized basalt	546		100	28/0/0/0			
	548		548		100	46/17/6/0			
91	550	Bottom of the hole at 550,32 m hole depth	550		100	61/41/19/0			

Ptobably >80 LU over 2 m interval

7 \otimes K-51
3,2 kN
18 MPa
K-52

6 \otimes
23,5 kN
200 MPa
K-52
K-53

9 \otimes
22,4 kN
191 MPa
K-53
K-54

8 \otimes K-55
2,4 kN
13 MPa
K-55

11 \otimes
4,0 kN
23 MPa
K-55
K-56

9 \otimes
25,3 kN
216 MPa
K-56
K-57

Vaðlaheiði west

Date Nov. 2010

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Empl. **Vegagerðin / Greið leið**

Corehole VK - 07 0 - 50 m

Design AgG

Drawn AgG

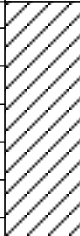







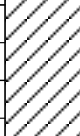


Coord. X: 544104

Y: 578256

Elev.: 209

Driller RFS

Drilled Nov. 2010

Elev. m a.s.l.	Depth m	Description of corehole VK - 07	Depth m	Rock column	Core %	RQD % 10 / 30 / 50 / 100	Q	GWT	Perm. (LU) 2,5 5,0 7,5
209	0	3" odex casing down to 3,3m depth. The hole is inclined 45° from vertical, towards WSW (247°) NQ drilling rods, triple tube. Core diameter 45mm. The hole is located approximately 175 m downhill from the old Vaðlaheidarvegur and some 240 m west from borehole VK-04	0						
206,7	2		2						
	4	Tholeiite basalt Medium light grey, fine grained Very hard and very high intact strength	4		100 100 100	0/0/0/0 26/0/0/0 53/0/0/0			
	6	Frequently jointed, joints rough, undulating, mainly coated with brown clay	6		100	49/23/10/0			
	8		8			$Q_c = \frac{50}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$			
	10	Scoriaceous basalt Scoriaceous basalt, brown and greyish brown, moderately strong, very porous vesicles up to 20 mm filled with zeolites	10		89 95	46/25/15/0 41/11/15/0			
	12		12			$Q_c = \frac{41}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$			
	14	Tholeiite basalt Tholeiite basalt, medium grey core, very hard and high intact strength, frequently and highly jointed, scattered large vesicles filled with zeolites	14		100 100	35/14/0/0 35/14/0/0			
	16	Thin dyke intrusion	16		100	60/0/0/0			
	18	Scoriaceous basalt Scoriaceous basalt, dark brown, mod. strong, well compressed and consolidated Possibly a mix of scoria and tectonic breccia	18		100 100	56/25/0/0 56/25/0/0			
	20	Tholeiite basalt Tholeiite basalt, medium grey core, very hard, frequently and highly jointed Inclination of hole 43,6° below horizontal	20		100 100	29/0/0/0 30/0/0/0			
	22	Scoriaceous basalt Scoriaceous basalt, brown, very porous rock of medium strength, very vesicular, vesicles filled with white zeolites-scolesite, stilbite	22		100 100	82/72/72/0 71/31/24/0			
	24		24			$Q_c = \frac{71}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$			
	26		26		100	56/0/0/0			
	28	Tholeiite basalt The tholeiite is porous in the uppermost part scolesite crystals in large vesicles Tholeiite basalt, medium grey core, very strong, hard and brittle rock, highly jointed, some joints healed with zeolites, 2-3% large vesicles half filled with zeolites - scolesite, stilbite	28		100 100	52/10/0/0 52/12/0/0			
	30		30			$Q_c = \frac{52}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$			
	32		32		100	57/13/0/0			
	34	Scoriaceous basalt Scoriaceous basalt, dark red brown, very well compressed and consolidated, moderately strong, relatively low porosity, small vugs filled with zeolites, competent tunnelling rock	34		100 100	74/58/0/0 75/36/22/0 75/41/16/0			
	36	Tholeiite basalt or possibly basaltic intrusion Tholeiite basalt, medium grey core, hard with high intact strength, several white veins of joints, healed with zeolites, chabazite	36		100	62/0/0/0			
	38		38		100	55/18/0/0			
	40	Crushed basalt over 1 m interval	40		100	59/0/0/0			
	42	Highly jointed hard basalt, joints rough, undulating, coated with light brown hard clay Very difficult to decide whether this is a basalt lava or a basalt intrusion Hard and strong basalt	42		100 100	39/39/39/0 48/0/0/0 55/23/0/0 61/32/15/8			
	44		44			$Q_c = \frac{61}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$			
	46	Several open joints with zeolite gauges, filling more than half of the original joint aperture	46		100	87/82/44/44			
	48		48		100	79/53/23/0			
173,6	50	Inclination of hole 44,2° below horizontal	50						

21 - 51 m depth. No leakage. Opens up at 6 bar pressure. Max testing pressure 7,6 bar; leakage ~ 1 LU

Vaðlaheiði west

Date Nov. 2010

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Empl. **Vegagerðin / Greið leið**

Corehole VK - 07 50 - 100 m

Design AgG

Drawn AgG

Coord. X: 544104 Y: 578256 Elev.: 209

Driller RFS

Drilled Nov. 2010

Elev. m a.s.l.	Depth m	Description of corehole VK - 07	Depth m	Rock column	Core %	RQD %	Q	GWT	Perm. (LU)
					10 / 30 / 50 / 100				2,5 5,0 7,5
173,6	50	Tholeiite basalt or possibly basaltic intrusion	50		100	36/0/0/0			
	52	Medium grey core, hard and with high intact strength, several white veins of joints, healed with zeolites, chabazite	52		100	41/0/0/0			
	54	Scoriaceous basalt Dark grey-brown well compressed and consolidated, porous, all vesicles filled with zeolites	54		100	82/75/75/0			
	54	Tholeiite basalt or basaltic dyke	54		100	33/0/0/0			
	56	Medium grey, very hard, intensely jointed Inner drilling rod not in place Joints rough, undulating, coated with brown clay	56		78	17/0/0/0			
	56	Scoriaceous basalt	56		0	0/0/0/0			
	58	Scoriaceous basalt, probably mixed with tectonic breccia at the top, grey-brown, moderately strong, well compressed and consolidated but porous	58	K-6	100	63/0/0/0			
	60	All pores filled with white zeolites relatively competent tunnelling rock	60	K-7	100	52/23/0/0			
	62	Tectonic breccia Tectonic breccia, well cemented with zeolites	62		100	50/20/0/0			
165,2	62	Basaltic dyke	62		100	63/43/0/0			
	64	Basaltic dyke, light grey core. Hard and strong basalt, moderately-highly jointed, some joints healed with zeolites, other rough, undulating, coated with light brown hard clay	64		100	83/3/83/0			
	66	Intensely jointed, most joints rough, planar, coated with brown hard clay	66	K-7	100	78/0/0/0			
	68	Highly jointed, thin joints frequently healed with zeolites	68	K-8	100	63/0/0/0			
	70		70		100	13/0/0/0			
	72	Crushed zone	72		100	35/0/0/0			
	74		74		100	43/10/0/0			
	76	Basaltic dyke or possibly tholeiite basalt, light grey core, hard and brittle, high intact strength	76	K-8	100	81/81/0/0			
	78	Intensely jointed, most joints rough, planar, coated with brown hard clay	78	K-9	100	0/0/0/0			
	80	Inclination of hole 44,5° below horizontal	80		100	0/0/0/0			
150,7	82	Sediment, sandstone Red sandstone - claystone, weak rock, red claystone crumbles at the base	82		92	66/0/0/0			
	84	Tholeiite basalt	84	K-9	100	53/0/0/0			
	86	Tholeiite basalt, scoriaceous at the top ca.1 m, then medium grey core, hard porous basalt, pores approx. 10% ≤ 30 mm, filled with white zeolites	86	K-10	100	54/9/0/0			
	88	Basaltic dyke	88		100	0/0/0/0			
	90	Basaltic dyke, dark grey core near weak contact, light grey core lower down, fine to medium grain size of crystals	90		100	0/0/0/0			
	92	Strong medium grained basalt, highly jointed	92		100	0/0/0/0			
	94	Highly broken and tectonized rock, recemented with calsite and zeolites	94	K-10	100	84/23/0/0			
	96	Tectonic breccia, part of the dyke	96	K-11	100	43/22/12/0			
	98	Crushed rock over 1,5 m interval	98		100	2,9 - 9,6			
138,3	100		100		100	43/10/0/0			

50 - 81 m depth. No leakage Opens up at 9 bar pressure. Max testing pressure 9,8 bar, leakage ~ 0,4 LU

71-111 m depth. No leakage Opens up at 9 bar pressure. Max testing pressure 10,5 bar, leakage ~ 0,5 LU

Vaðlaheiði west

Date Nov. 2010 Page 3 of 5

Empl. **Vegagerðin / Greið leið**

Corehole VK - 07 100 - 150 m

Design AgG Drawn AgG

Coord. X: 544104 Y: 578256 Elev.: 209

Driller RFS Drilled Nov. 2010

Elev. m a.s.l.	Depth m	Description of corehole VK - 07	Depth m	Rock column	Core %	RQD % 10 / 30 / 50 / 100	Q	GWT	Perm. (LU) 2,5 5,0 7,5
138,3	100	Basaltic dyke The contact is cemented with zeolites	100		100	57/45/29/0			
	102	Tholeiite basalt Tholeiite basalt, light grey core, very hard and brittle, very high intact strength but highly to intensely jointed	102		100	31/0/0/0			
	104	Tectonized rock, joints frequently recemented with zeolites causing white veins	104		100	34/21/0/0			
	106		106		100	52/28/10/0			
	108	Scoriaceous basalt - Tectonic breccia well consolidated with zeolites	108		93	83/83/83/0			
132,6	108	Sediment, sandstone Dark red sandstone, weak rock, not clayous	108		100	0/0/0/0			
	110	Scoriaceous basalt Grey and brown well compressed and consolidated, moderately strong rock Inclination of hole 44,9° below horizontal	110		100	76/61/30/0			
	112	Scoriaceous basalt, dark grey-brown, well compressed and consolidated	112		100	66/45/22/0			
	114	Possibly tectonic breccia in the scoriaceous basalt, well cemented with zeolites	114		100	68/48/24/0			
	116	Basaltic dyke Basaltic dyke, light grey core, hard, very high intact strength	116		100	55/0/0/0			
	118	Frequent joints, planar or rough undulating, some thin white veins of healed joints	118		100	61/61/0/0			
	120		120		100	47/31/0/0			
	122		122		100	72/59/0/0			
	124	-----: Sediment zone, sandstone 0,2 m, cemented to the basalt	124		100	0/0/0/0			
120,6	124	The core breaks up at the contact	124		100	21/0/0/0			
	126	Sediment, sandstone Sediment, sandstone, dark grey and red, weak to very weak rock, partly waxy core. Stiff hard sandstone at the base ca.0,7 m (weak rock)	126		100	53/53/0/0			
	128	Tholeiite basalt or very fine grained crystalline dyke Tholeiite basalt, possibly mixed with dyke intrusions	128		100	40/0/0/0			
	130	Not clearly defined rock type, porous basalt of high strength, pores filled with zeolites	130		100	33/0/0/0			
	132	-----: Scoriaceous zone	132		100	45/0/0/0			
	134	Scoriaceous basalt Scoriaceous basalt, dark purple grey, moderately strong, originally very porous but most pores filled with zeolites	134		100	54/19/0/0			
	136	Scoriaceous basalt, well compressed and consolidated moderately strong	136		100	53/11/0/0			
	138	Competent tunneling rock. Inclination of hole 45,4° below horizontal	138		100	67/11/0/0			
	140	Tholeiite basalt Tholeiite basalt, medium grey core, very hard and brittle, micropore flow banding	140		100	0/0/0/0			
	142	Intensely jointed around longitudinal joint	142		100	33/16/0/0			
	144	Scoriaceous basalt Scoriaceous basalt, dark purple grey, well compressed and consolidated moderately strong with weak zones	144		100	57/28/0/0			
	146	Tholeiite basalt	146		100	33/0/0/0			
	148	Tholeiite basalt-intermediate basalt, medium hard, high intact strength but intensely jointed, small pores ≤ 10% half filled with zeolites	148		100	42/0/0/0			
102,9	150	Basaltic dyke Dark grey core, hard, very high intact strength	150		100	69/0/0/0			

111-140,7 m depth. No leakage Opens up at 11 bar pressure. Max testing pressure 12 bar, leakage ~ 0,5 LU

10
3,0 kN
17 MPa

(5)
(18,8) kN
(160) MPa

9
5,2 kN
34 MPa

(N)

Vaðlaheiði west

Date Nov. 2010

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Empl. **Vegagerðin / Greið leið**

Corehole VK - 07 150 - 200 m

Design AgG

Drawn AgG

Coord. X: 544104 Y: 578256 Elev.: 209

Driller RFS

Drilled Nov. 2010

Elev. m a.s.l.	Depth m	Description of corehole VK - 07	Depth m	Rock column	Core %	RQD %	Q	GWT	Perm. (LU)
102,9	150	Basaltic dyke Dark grey core, hard, very high intact strength	150			10 / 30 / 50 / 100			2,5 5,0 7,5
	152	Tholeiite basalt The contact breaks up	152		100	83/73/0/0			140-180m depth. Max testing pressure 10 bar, No leakage
	154	Tholeiite basalt-intermediate basalt, medium grey core, very hard and high intact strength Moderately to highly jointed, joints rough undulating, coated with thin blueish and brown clay Several white veins at joints healed with zeolites	154	8 \times 17,4 kN 148 MPa	100	61/37/18/0 64/42/42/0			
	156	Very unclear wheather this unit is a basalt lava or an intrusion	156		100	44/28/28/0			
	158		158	K-17 K-18	100	56/18/0/0			
96,6	160	Sediment, sandstone Sediment, red sandstone, weak rock, breaks up, coarse grained sandstone-fine grained conglomerate	160		100	82/31/0/0 29/0/0/0			
	162	Tholeiite - Olivine basalt Olivine basalt not obvious classification, medium grey, very vesicular, most vesicles filled with zeolites	162	9 \times 2,7 kN 15 MPa	100	73/47/26/0			
	162	Sediment, dark grey claystone. weak rock	162		100	100/100/0/0 0/0/0/0			
	164	Scoriaceous basalt Purple grey, very well compressed, moderately strong	164		100	58/0/0/0			
	166	Basaltic dyke Basaltic dyke, dark grey, microporous, strong basaltic rock	166	12 \times 3,4 kN 19 MPa	100	15/0/0/0 47/0/0/0			
	168	Composite dykes, vesicular flow structures filled with zeolites Inclination of hole 45,6° below horizontal	168	K-18 K-19	100	66/43/43/0 83/22/0/0			
	170	Tholeiite basalt Tholeiite basalt, medium-light grey core, very hard and brittle, very high intact strength, moderatly jointed, microporous, small pores 2-6% filled with black clay.	170	9 \times 22,8 kN 164 MPa	100	58/0/0/0 63/50/0/0			
	172	Faint micropore flow banding	172		100	82/64/53/53			
	174		174		100	65/47/22/22			
	176	Scoriaceous basalt 0,5 m at base	176	K-19	100	72/45/0/0			
83,8	176	Sediment, sandstone Sandstone-claystone, dark brown, weak	176	K-20	100	0/0/0/0			
	178	Scoriaceous basalt Scoriaceous basalt, dark purple-grey, well compressed and consolidated, moderately low intact strength, competent tunnelling rock	178		100	77/30/0/0			
	180		180		100	77/77/30/19			
	182		182	10 \times 3,6 kN 21 MPa	100	77/57/57/35			
	184	Tholeiite basalt Tholeiite basalt - Intermediate olivine-tholeiite basalt, medium grey core, microporous, hard and strong	184	9 \times 19,2 kN 164 MPa	100	68/48/0/0			
	186		186	K-20 K-21	100	75/61/23/0			
	188	Moderately jointed, joints rough undulating, many joints are healed with zeolites	188		100	71/53/20/0			
	190		190		100	64/43/31/0			
	192		192		100	78/64/28/0			
	194	Tectonized and brecciated rock, formerly open joints healed with zeolites	194	K-21 K-22	100	37/0/0/0			
	196	Scoriaceous basalt Scoriaceous basalt, brown moderately strong, porous, 10-20% vesicles filled with zeolites	196		100	46/0/0/0 54/0/0/0			
	198	Basaltic dyke Basaltic dyke, medium grey, microporous strong rock	198	10 \times 11,6 kN 88 MPa	100	86/86/60/0			
67,6	200	Scoriaceous basalt Scoriaceous basalt, grey brown well compressed and consolidated, porous but all pores filled with zeolites	200	4 kN 23 MPa	100	87/77/59/39			

180-216m depth. No leakage Opens up at 13 bar pressure. Max testing pressure 13 bar, leakage ~ 1,5 LU

Elev. m a.s.l.	Depth m	Description of corehole VK - 07	Depth m	Rock column	Core %	RQD % 10 / 30 / 50 / 100	Q	GWT	Perm. (LU) 2,5 5,0 7,5
67,6	200	No clear definition of scoria-basalt boundary Inclination of hole 45,7° below horizontal	200		100	87/77/59/39			
	202	Porphyritic basalt Porphyritic basalt, medium grey core, approx. 20% small plagioclas phenocrystals ≤ 3 mm, very strong-strong, microporous basalt, moderately jointed, joints rough, undulating, coated with black clay	202		100	70/12/0/0			
	204		204		100	74/43/26/17			
	206	Vesicles approximately 3-5% filled with black clay	206		100	71/48/22/0			
	208		208		100	$Q_c = \frac{74}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$			
	210		210		100	85/63/37/37			
	212		212		100	52/0/0/0			
	214	Scoriaceous basalt Scoriaceous basalt, grey and brown, very well compr. and consolidated Diffuse boundary between scoria and basalt	214		100	92/65/65/0			
	216	Tholeiite basalt Tholeiite basalt, medium grey core, very strong rock, porous in the upper half, 10-20% small vesicles filled with black clay and white zeolites	216		100	77/56/40/0			
	218		218		100	53/41/0/0			
	220		220		100	46/31/31/0			
53	222	Sediment, sandstone - claystone Sediment, very dark brown and red sandstone-claystone, Very weak rock, waxy surface on core	222		100	78/56/47/26			
	224	Sandstone-conglomerate, scoriaceous fragments, mostly ≤ 20mm cemented in sandstone matrix, moderately strong rock	224		100	97/74/54/54			
	226	Scoriaceous pebbles in red sandstone matrix below 225 m No weakness at diffuse layer boundary	226		100	$Q_c = \frac{78}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$			
49,1	228	Scoriaceous basalt Scoria mixed with sandstone, the ratio of scoria fragments increase downwards, red and red grey-brown	228		100	87/56/56/0			
	230	Some water loss Inclination of hole 45,9° below horizontal	230		100	49/19/0/0			
	232	Scoriaceous basalt, tectonized but partly recemented at 232-233 m depth	232		100	74/60/53/0			
	234	Unclear - diffuse layer boundary	234		100	90/80/80/0			
	236	Tholeiite basalt Tholeiite basalt, medium grey core, very hard and brittle, extremely high intact strength	236		100	90/80/80/0			
	238	Water loss Scattered pores < 4% filled with zeolites and black clay	238		100	$Q_c = \frac{74}{6-9} \times \frac{1-2}{3-4} \times \frac{1}{1}$			
	240	Faint micropore flow banding Intensely jointed and crushed zone Inclination of hole 45,9° below horizontal	240		100	93/83/53/17			
	242	Tectonized basalt, former joints healed with zeolites	242		100	$Q_c = \frac{93}{9-10} \times \frac{2-4}{2-3} \times \frac{1}{1}$			
	244	The core is highly broken along longitudinal joints	244		100	100/100/100/0			
	246	The rock is very dense and without any pores below 247 m depth	246		100	50/50/0/0			
	248	Water loss Inclination of hole 46,1° below horizontal	248		100	81/67/33/33			
32,2	250	Bottom of hole at 252,08 m depth	250		100	81/67/33/33			

216-252m depth. Two leaking joints Max testing pressure 9,5 bar, leakage ~ 6 LU over the whole interval. Max flow 210 l/min

Open joint possibly ~100 LU

Open joint possibly ~100 LU