EUB/AGS Geo-Note 2005-07

Auger Core Lithologs, Sawn Lake Area, Southern Buffalo Head Hills, Alberta

Alberta Energy and Utilities Board

Alberta Geological Survey

AGS

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Alberta Geological Survey

June 2005

ISBN 0-7785-3854-0

Pawlowicz, J.G., Fenton, M.M. and Weiss, J.A. (2005): Auger core lithologs, Sawn Lake area, southern Buffalo Head Hills, Alberta; Alberta Energy and Utilities Board, EUB/AGS Geo-Note 2005-07, p. 48.

Published June 2005 by:
Alberta Energy and Utilities Board
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Acknowledgments

The authors extend their thanks to the following individuals of the Alberta Geological Survey for their assistance: T. Berezniuk for typing the lithologs into the database, T. Nicoll for creating the figures and formatting the lithologs, G. Prior and G. Hippolt-Squair for editing the report, and M. Protz for preparing the manuscript for publication.

Abstract

This report presents lithological descriptions from 11 auger coreholes drilled by the Alberta Geological Survey (AGS) during 2002 in the southern Buffalo Head Hills within the Sawn Lake map area (NTS 84B/13). The drilling was done to obtain information on the Quaternary stratigraphy and glacial dispersion of kimberlite mineral indicators within the Buffalo Head Hills kimberlite field. Drillholes were cored to depths of 11.6 to 43.6 metres. Bedrock was recovered from seven of the auger holes. Drift was encountered in all holes and ranged in thickness from 2.2 to 43.6 metres. A buried weathered zone indicates two till units with significantly different ages are present. The core was logged in the field during drilling and later sampled for geochemical, texture and kimberlite indicator mineral analyses. In addition, palynology samples were collected from the bedrock.

1 Introduction

The Alberta Geological Survey (AGS) is continuing its efforts to collect information in the poorly mapped regions of northern Alberta to better understand the Quaternary geology and near-surface bedrock geology. Eleven auger core holes were drilled by the AGS during 2002 primarily to collect information about Quaternary stratigraphy and glacial dispersal of kimberlite indicator minerals in the southern Buffalo Head Hills within the Sawn Lake map area (NTS 84B/13; Figures 1 and 2). The coreholes were located within the Buffalo Head Hills kimberlite field, which contains a minimum of 38 kimberlite bodies discovered by Ashton Mining of Canada Inc. and its partners (Eccles et al., 2003; Skelton et al., 2003). Holes were cored to depths of 11.6 to 44 m and, in addition to Quaternary core, bedrock was recovered from seven of the auger holes drilled near kimberlite K4. The purpose of this report is to present the lithological descriptions of the core. The drillhole information complements earlier studies on drift thickness mapping and stratigraphy by Pawlowicz and Fenton (2002), Pawlowicz et al. (2005a) and Pawlowicz et al. (2005b). Analytical results of the core are not included in this report, but are the subject of other AGS reports (M. Fenton et al., work in progress; Pawlowicz et al., 2005).

2 Methodology

Drill sites were located within existing clearings next to available road access to minimize environmental disturbance and cost. Land access permits were obtained in advance from Alberta Sustainable Resource Development. A truck-mounted drilling rig (MS-61) equipped with hollow stem auger and a Central Mining Equipment (CME) split core barrel was used. The rig could drill to a maximum depth of 50 metres. The CME core tube consisted of a split barrel 1.5 metres long and 7.6 centimetres in diameter. Auger coring with the CME tube performed well in all materials encountered, including unconsolidated surficial sediments and poorly consolidated mudstone, siltstone and sandstone bedrock formations. Each hole was cored continuously from surface. The core was logged during drilling in the field by AGS personnel. Drilling was completed over a seven-day period in August 2002. All cores were boxed and shipped to the AGS Mineral Core Research Facility in Edmonton. Samples of core were later selected for geochemical, texture, kimberlite-indicator mineral and bedrock palynology analyses. Locations of drillhole collars were determined using a single, hand-held GPS unit. Collar elevations were estimated by determining the elevations at each collar location from the 1:50 000 topographic map of the area (Energy, Mines and Resources Canada, 1989; Sawn Lake, 84B/13, Edition 2). A summary of the 2002 auger-core drilling is presented in Table 1.

3 Results

Lithocolumn plots are presented in Appendix 1, which show the general lithology for each corehole. The detailed lithological descriptions are in Appendix 2. Core recovery data, included in the lithological descriptions, may be used to identify zones of missing core. Large intervals of missing core (approximately greater than one metre) are shown as such on the lithocolumns. All holes were drilled in the Sawn Lake area within the Buffalo Head Hills kimberlite field (Figure 2). Coreholes BHH02-01 to 09 were drilled within 4 km of the K4 kimberlite complex on the upper flank of the Buffalo Head Hills, and holes BHH02-10 and 11 were drilled farther to the northwest on top of the Buffalo Head Hills. Drift cover was relatively thin in the K4 area and thicker to the west as shown by bedrock intersections and drift thicknesses in Table 1. The primary purpose of drilling in this program was to core the surficial sediments; however, where bedrock was intersected at shallow a depth, holes were drilled 11.6 to 25.3 m into bedrock.

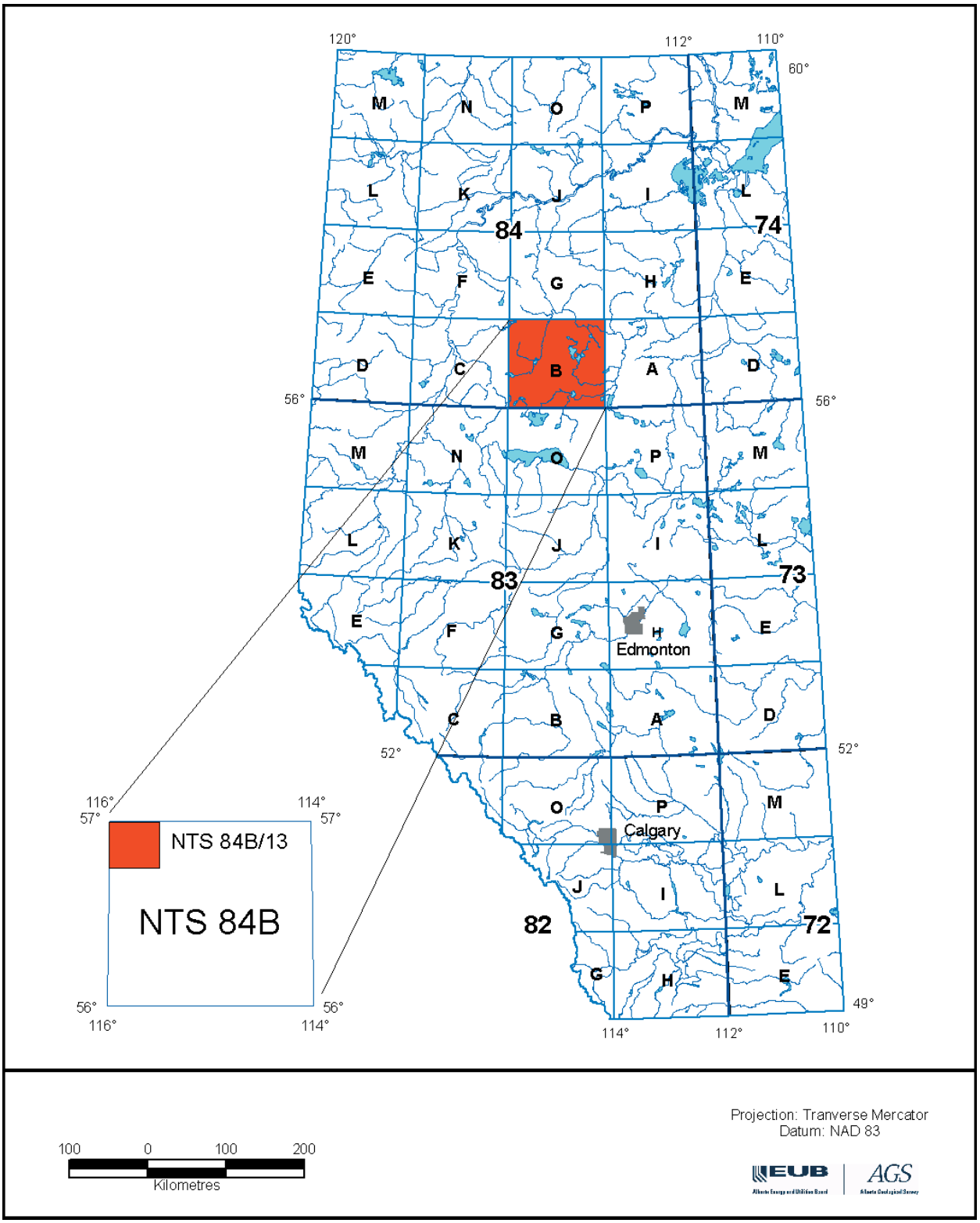

Figure 1. Location of Sawn Lake area (NTS 84B/13), Alberta.

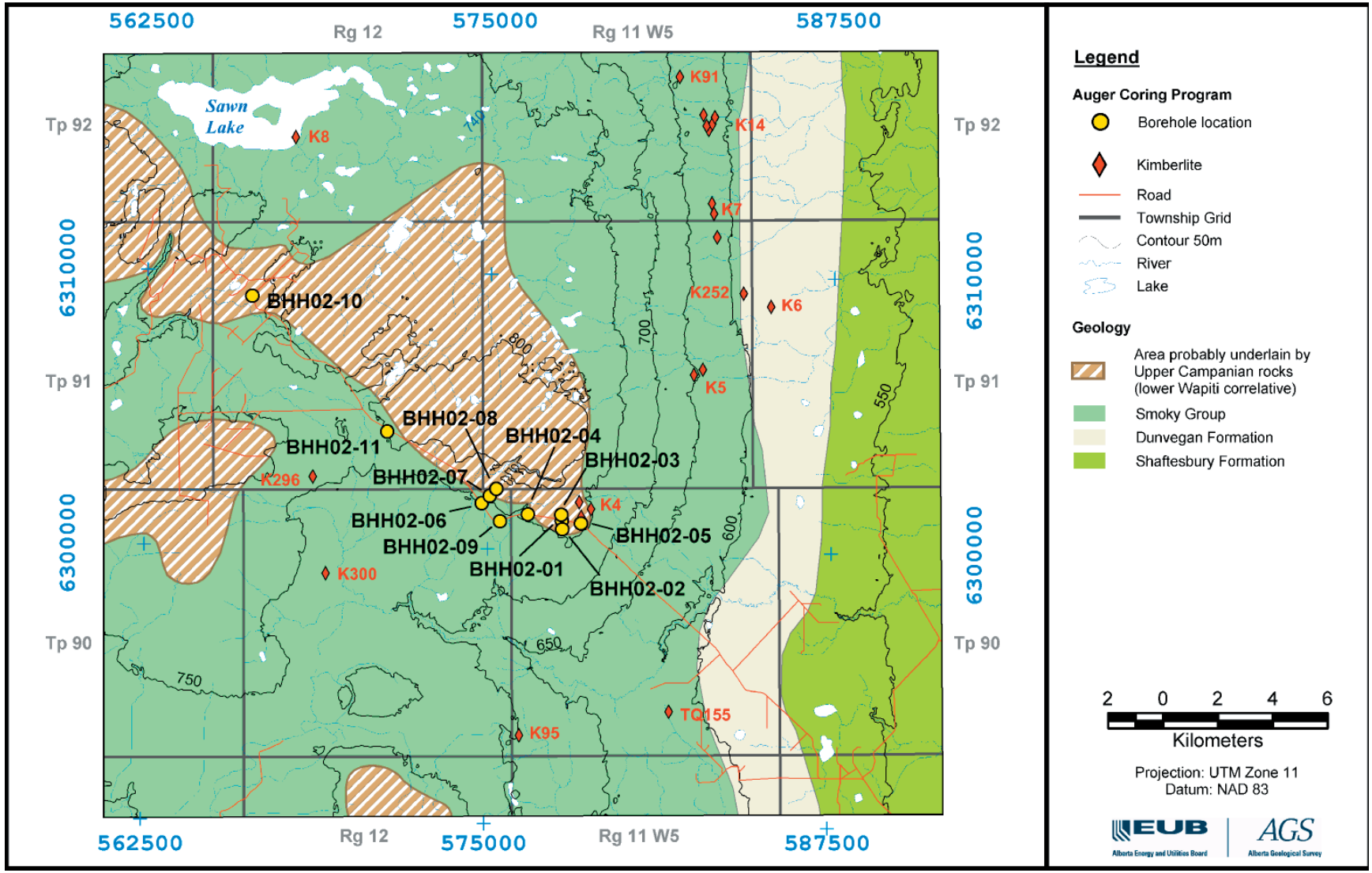

Figure 2. Geology of Sawn Lake map area (84B/13) showing location of coreholes (from Pawlowicz et al., 2005).

Table 1. Summary of 2002 auger-core drilling

Auger Hole	East[1]	North[1]	NTS Map Area	Collar Elevation (masl)[2]	Depth (m)[3]	Bedrock Intersection	Drift Thickness(m)
BHH02-01	577678	6301069	84B/13	768	25.3	yes	7.7
BHH02-02	577706	6300759	84B/13	758	11.6	yes	6.5
BHH02-03	577660	6301281	84B/13	779	11.6	yes	3.4
BHH02-04	576440	6301278	84B/13	758	11.9	no	>11.9
BHH02-05	578377	6300975	84B/13	761	13.1	yes	5.5
BHH02-06	574761	6301658	84B/13	751	11.6	yes	2.2
BHH02-07	575047	6301929	84B/13	774	13.1	yes	9.3
BHH02-08	575284	6302188	84B/13	786	36.0	no	>36.0
BHH02-09	575433	6301009	84B/13	738	16.2	yes	10.5
BHH02-10	566305	6309085	84B/13	781	23.8	no	>23.8
BHH02-11	571286	6304213	84B/13	796	43.6	no	>43.6

[1]UTM Zone 11, NAD 83
[2]metres above sea level
[3]metres below ground surface

Quaternary sediments were intersected in all holes with drift thickness ranging from 2.2 m to greater than 43.6 m (Table 1). Till was found at surface in all holes except BHH02-09, where glaciofluvial sand and gravel was encountered. The surficial geology observed in drilling corroborate the results of surficial mapping by Paulen et al. (2003), Paulen et al. (2004) and Trommelen (2004). Strong evidence for two distinct tills was observed in corehole BHH02-11 in which buried weathered till and stratified sediments separate an upper till from lower till. The upper till is dark grey-brown and has a fine-grained matrix of silty clay, is strongly calcareous and contains less than 5% clasts consisting of igneous and metamorphic rocks, Athabasca sandstone, quartzite, limestone and minor local (Cretaceous), poorly consolidated shale and sandstone. The lower till observed in coreholes BHH02-07, 08 and 11 has a darker grey colour, is noncalcareous and has a higher proportion of shale clasts. Weathered kimberlite clasts were found in the lower till from coreholes BHH02-07 and 08, located approximately 3.5 km west of the K4 kimberlite complex (which may be the source of the clasts).

Bedrock intersected in seven of the coreholes is dominantly mudstone of the Upper Cretaceous Smoky Group, as mapped by Green et al. (1970) and shown on the Geology Map of Alberta (Hamilton et al., 1999). However, in a few of the holes, the presence of sandstone beds, some with carbonaceous laminae, and recently acquired palynological results indicate a younger age that correlates with the Wapiti Formation (Pawlowicz et al., 2005; Figure 2). The bedrock is poorly consolidated and was relatively easy to core with the auger rig. Bedding was horizontal and no deformation was observed that might suggest glaciotectonism.

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Appendix 1 – Lithological plots of coreholes

Legend

BHH02-01

BHH02-02

BHH02-03

BHH02-04

BHH02-05

BHH02-06

BHH02-07

BHH02-08

BHH02-09

BHH02-10

BHH02-11

Legend

NO DATA / CORE LOSS

FILL

TOPSOIL

CLAY

SILT

CLAY AND SILT

SAND

SAND, SILT AND TILL

GRAVEL

GRAVEL AND SAND

TILL

OXIDIZED TILL

CLAYEY TILL

SILTY TILL

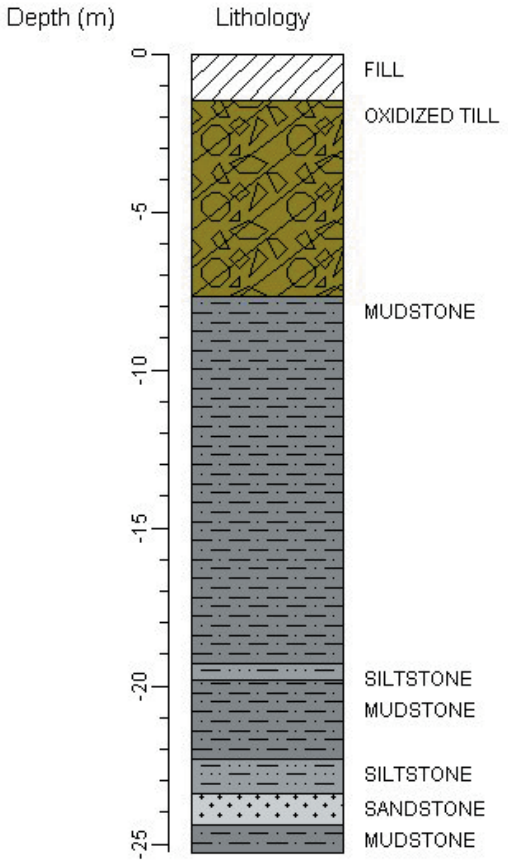
SANDY TILL

MUDSTONE

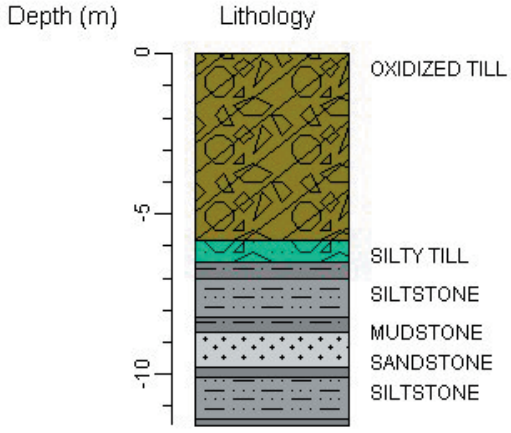
SILTSTONE

SANDSTONE

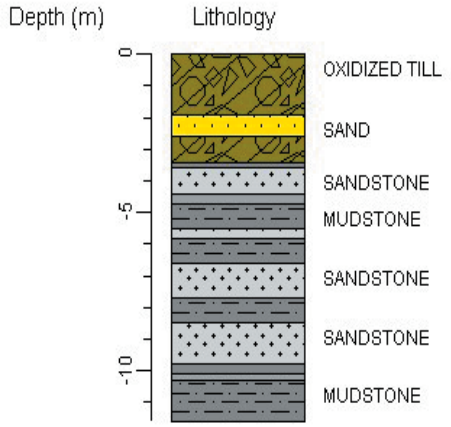
Well Name: BHH02-01
Location (UTM): 577678E 6301069N
Ground Elevation: 768 m
Date: 20/08/2002



Well Name: BHH02-02
Location (UTM): 577706E 6300759N
Ground Elevation: 758 m
Date: 21/08/2002



Well Name: BHH02-03
Location (UTM): 577660E 6301281N
Ground Elevation: 779 m
Date: 21/08/2002



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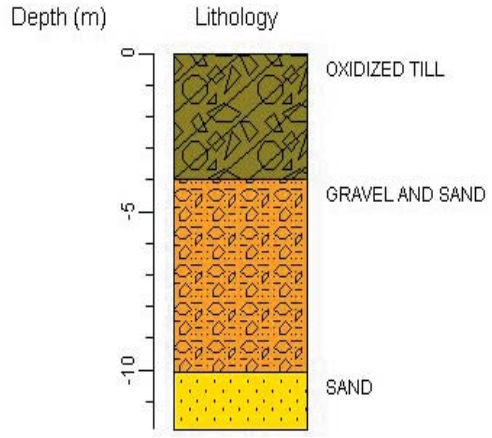
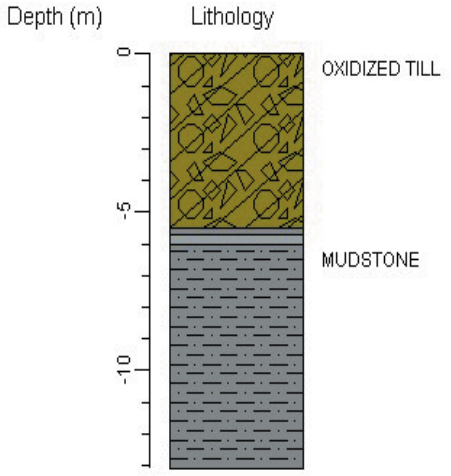
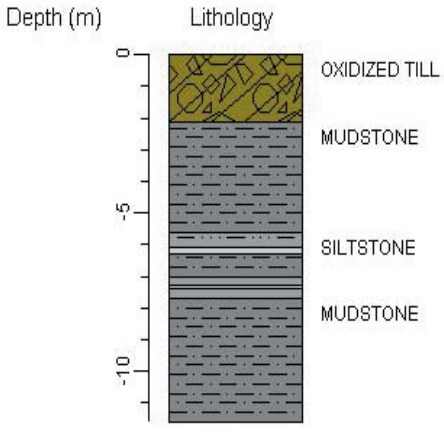
Location (UTM): 576440E 6301278N
Ground Elevation: 758 m
Date: 22/08/2002



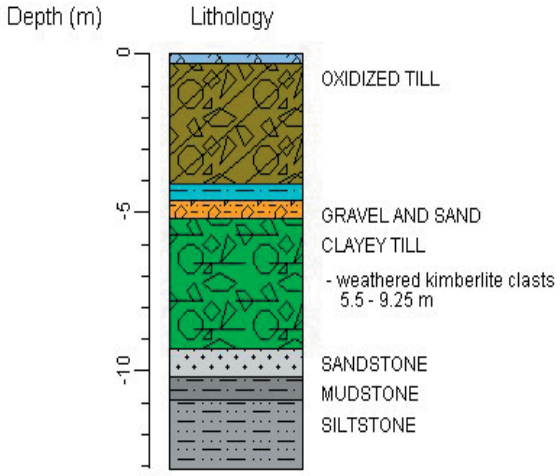
Well Name: BHH02-05
Location (UTM): 578377E 6300975N
Ground Elevation: 761 m
Date: 22/08/2002



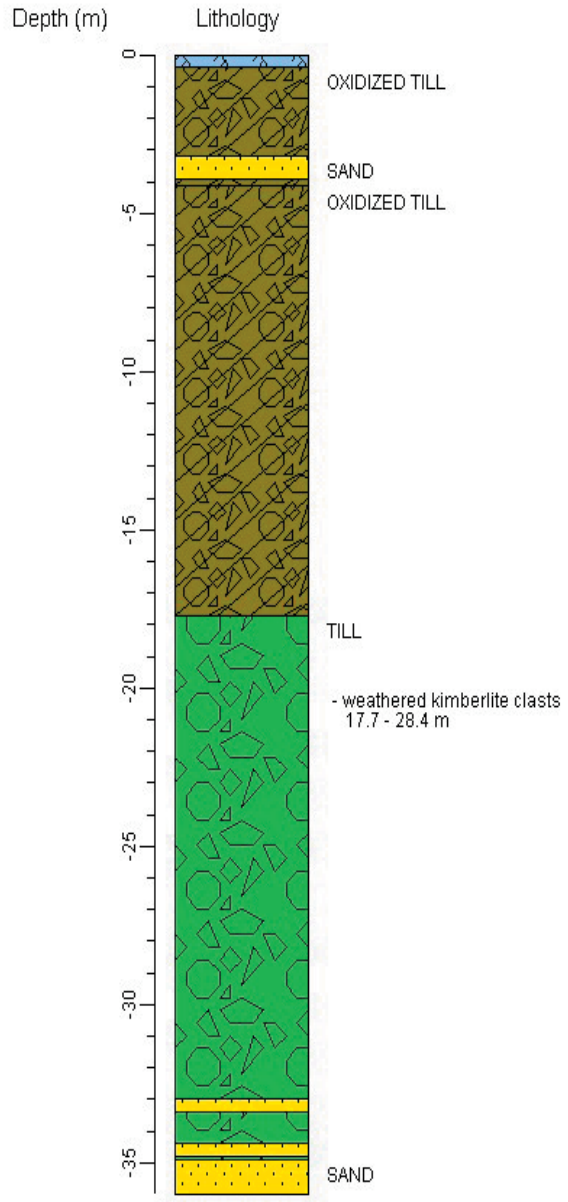
Well Name: BHH02-06
Location (UTM): 574761E 6301658N
Ground Elevation: 751 m
Date: 23/08/2002



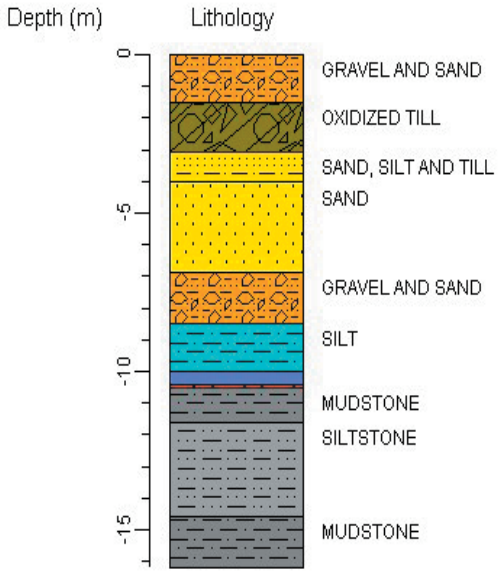
Well Name: BHH02-07
Location (UTM): 575047E 6301929N
Ground Elevation: 774 m
Date: 23/08/2002



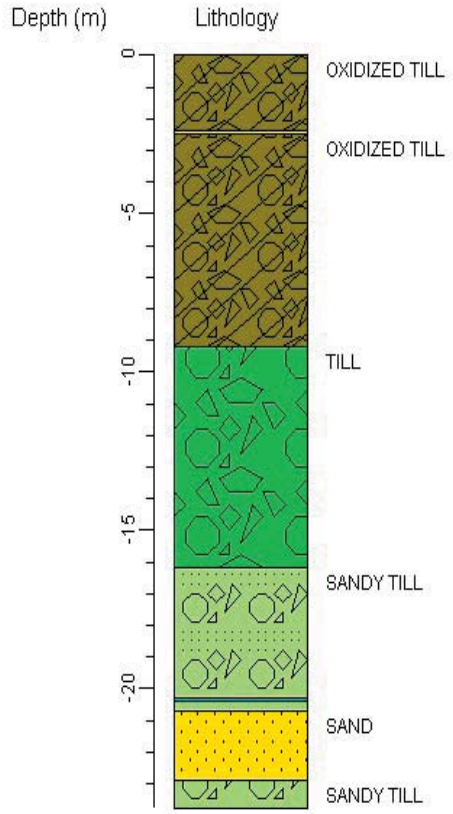
Well Name: BHH02-08
Location (UTM): 575284E 6302188N
Ground Elevation: 786 m
Date: 24/08/2002



Well Name: BHH02-09
Location (UTM): 575433E 6301009N
Ground Elevation: 738 m
Date: 25/08/2002



Well Name: BHH02-10
Location (UTM): 566305E 6309085N
Ground Elevation: 781 m
Date: 23/08/2002



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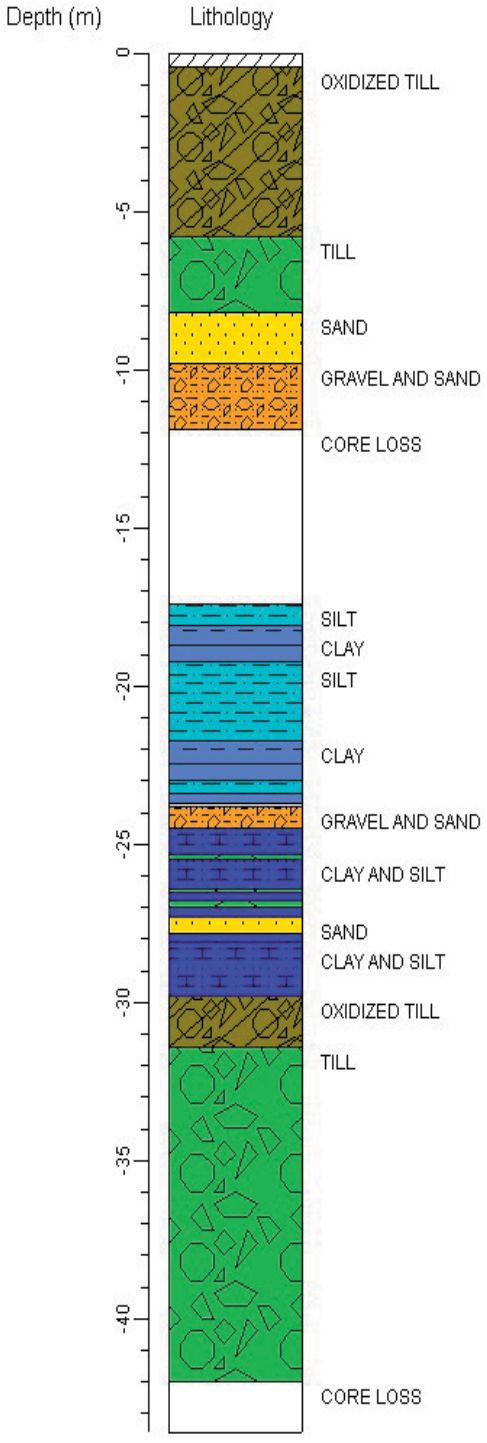
Location (UTM): 571286E 6304213N
Ground Elevation: 796 m
Date: 26/08/2002



Appendix 2 – Lithological descriptions of coreholes

BHH02-01

BHH02-02

BHH02-03

BHH02-04

BHH02-05

BHH02-06

BHH02-07

BHH02-08

BHH02-09

BHH02-10

BHH02-11

Drill Site BHH02-01

Date *20-Aug-02*
Logged By *J. Pawlowicz*
Drill Company *Canadian Geological Drilling*
Driller *Ken Pearson*
Drill Type *MS-61 Auger Rig*
Location *Buffalo Head Hills*
LSD *5* **Sec** *32* **Tp** *90* **Rg** *11* **W** *5M*
Longitude *-115.72648° W* **Latitude** *56.84692° N* *NAD 83*
Ground elevation (m) *768* **Source** *approximated from 1:50 000 topographic maps*
Total depth (m) *25.3*
Conditions *sunny, warm*
Site Comments *UTM_E 577678, UTM_N 6301069, UTM Zone 11; driveway entrance to cutblock - built up at lease 1 m*

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
0	0.91	0.70	0.45	Fill	clayey sand, stony, brown
			0.25	Fill, Silt	light grey, massive, organics in the top 10 cm, 5 cm of wood at base, non-calcareous
0.91	1.52	0.60	0.45	Fill, Silt	same as above, becoming oxidized brown at base, roots, non-calcareous
			0.15	Fill, Diamict	sandy silt, massive, minor pebbles, roots, oxidized brown, limestone, igneous and ironstone clasts, moved auger rig over 0.6 m and drilled down to 1.5 m with solid stem auger.
1.52	3.66	1.50	1.50	Till	started coring at 1.52 m, clayey silt, brown oxidized, strongly calcareous, massive, soft, stony (igneous, quartzite, limestone, ironstone, minor brown shale and minor red oxidized siltstone clasts), sample disturbed from augering
3.66	5.50	1.45	0.74	Till	brown, massive, silty clay, weakly calcareous, stiff, very few clasts (mostly black shale with minor igneous and local sandstone clasts)
			0.35	Till	silty clay horizontal banding, dark grey-brown, brown oxidized sandy zones, minor clasts and granules, black shale clasts, stiff, non-calcareous.
			0.36	Till	very dark grey-brown, oxidized, silty clay, massive, non-calcareous, strongly oxidized horizontal fractures, minor clasts and granules, minor shale clasts, very stiff.
5.50	7.01	1.12	0.86	Till	same as above, dark grey, unoxidized with strongly oxidized fractures, clayey silt, slightly calcareous, minor clasts: shale, igneous, sandstone, quartzite
			0.26	Till	as above except with brown oxidized silt bedding (5 cm), strongly calcareous

Drill Site BHH02-01

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
7.01	8.53	1.53	0.72	Till	dark grey-brown, dark brown oxidized zones, massive, clayey silt, moderately calcareous, stiff and plastic, moderately stony: igneous, sandstone, and ironstone clasts; abrupt contact with unit below
			0.81	Mudstone	silty, oxidized, mottled grey and dark grey, horizontal silty interbeds, strongly oxidized beds, no pebbles or granules, shale dropstone, possibly glaciolacustrine clay but likely crushed mudstone, stiff
8.53	10.05	0.95	0.95	Mudstone	dark grey, no pebbles or granules, unoxidized, faint horizontal silt beds, very slightly calcareous, friable, minor deformed light grey silt? laminae - from drilling
10.05	11.58	1.57	1.57	Mudstone	same as above, massive, dark grey, light grey faint mottling, minor white carbonate specks, non-calcareous matrix, waxy, friable, crushed mudstone.
11.58	13.10	1.64	1.64	Mudstone	same as above, mottled light grey and dark grey, mostly non-calcareous with minor calcareous silt laminae, friable, no pebbles or granules
13.10	14.63	1.60	1.40	Mudstone	same as above, silty, dark grey, unoxidized, non-calcareous, mostly massive, friable, some harder broken blocks 1-2 cm in diameter, minor sparkly grains (possibly fine-grained sand, mica or gypsum)
			0.20	Siltstone	dark grey horizontal fine-grained sand and silt beds, sand is strongly calcareous, minor grey sandstone clasts
14.63	16.15	0.20	0.20	Siltstone	same as above, poor recovery, sample chewed up, twisted
16.15	17.67	1.56	1.56	Mudstone	silty, dark grey, massive, stiff but friable, non-calcareous, slightly mottled, minor faint contorted light grey silt laminae, waxy, easily cut with knife
17.67	19.20	1.60	1.60	Mudstone	clayey with faint silty clay beds, non-calcareous, minor white shell fragments, minor very thin (>1 mm) light grey silt stringers 2 cm long - calcareous, bedding likely horizontal - deformation from drilling, no pebbles or clasts
19.20	20.73	1.49	0.05	Mudstone	as above
			0.54	Siltstone	moderately calcareous in upper 10 cm, clayey, dark grey, friable
			0.90	Mudstone	
20.73	22.25	0.63	0.63	Mudstone	as above, core chewed up from drilling into small pieces, poor recovery possibly due to stone (calcareous sandstone) found at bottom of shoe, waxy, very hard clay fragments, uncertain if stone in place (water level at 21 m)

Drill Site BHH02-01

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
22.25	23.77	1.66	0.08	Sandstone	dark grey, medium-grained, calcareous, cemented sandstone bed broken from drilling, very hard, water-bearing
			1.15	Siltstone	clayey, horizontally bedded, stiff, slightly calcareous, dark greenish grey
			0.43	Sandstone/Siltstone	interbedded very fine-grained sandstone and clayey siltstone, very stiff, dark greenish grey, slightly calcareous, one dark brown (carbonaceous?) lamination, minor thin 3 mm tan coloured clay beds (moderately calcareous)
23.77	25.30	1.55	0.65	Sandstone	dark greenish grey, very fine-grained, clayey and silty interbeds, horizontal beds, non-calcareous
			0.90	Mudstone	dark grey, silty, horizontal siltstone bedding, non-calcareous, last 3 m looks like typical local Cretaceous bedrock; TD at 25.3 m

Drill Site BHH02-02

Date *21-Aug-02*
Logged By *J. Pawlowicz*
Drill Company *Canadian Geological Drilling*
Driller *Ken Pearson*
Drill Type *MS-61 Auger Rig*
Location *Buffalo Head Hills*
LSD *4* **Sec** *32* **Tp** *90* **Rg** *11* **W** *5M*
Longitude *-115.72612° W* **Latitude** *56.84413° N* *NAD 83*
Ground elevation (m) *758* **Source** *approximated from 1:50 000 topographic maps*
Total depth (m) *11.6*
Conditions
Site Comments *UTM_E 577706, UTM_N 6300759, UTM Zone 11; site located 300 m south of BHH02-1 in wide cleared area*

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
0	1.22	0		Till	very stony, bouldery, drilled through with solid auger
1.22	2.44	0		Till	few stones, drilled through to core point at 2.4m
2.44	3.96	1.40	1.40	Till	dark brown, oxidized, calcareous (moderately to strong), iron staining along high-angle fractures, 3% clasts: rotten limestone (abundant), ironstone, igneous, quartzite, minor shale; clayey silt, massive, stiff and plastic, becoming mottled towards base
3.96	5.49	1.47	1.47	Till	very dark grey-brown, core deformed from drilling in upper 1.07 m, strongly calcareous, higher igneous clast content, ironstone clasts, strong oxidation along horizontal fractures, stonier than above, mottled
5.49	7.01	1.46	0.93	Till	clayey silt, massive, very plastic, dark grey, unoxidized with oxidized fractures in top 30 cm, a few large igneous clasts disturbing core, very moist, few clasts (2%): igneous, shale, quartzite, and limestone; strongly calcareous, sharp contact with unit below
			0.53	Mudstone	dark grey with grey silty horizontal beds, stiff but easily cut with knife, upper 25 cm is clay with broken mudstone clasts (2-3 cm in diameter), very slightly calcareous
7.01	8.53	1.05	0.44	Siltstone	dark grey, massive, minor clay, highly fractured, moderately calcareous, water level at 7.47 m
			0.10	Sandstone	dark grey, fine-grained, strongly calcareous, very hard, broken from drilling, water zone
			0.20	Siltstone	dark grey, light grey horizontal laminae, slightly calcareous, poorly indurated
			0.31	Mudstone	massive, mottled dark grey and grey, waxy, bentonitic?, slightly calcareous, slight H2S odour from acid reaction

Drill Site BHH02-02

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
8.53	10.06	1.58	0.17	Mudstone	very dark grey, massive, as above, broken from drilling
			0.33	Siltstone	clayey, massive, dark grey, soft, gradationall contact with unit below, very slightly calcareous
			0.78	Sandstone	dark greenish grey, massive, slightly calcareous, very fine to fine-grained, fining upwards, abrupt contact with unit below
			0.30	Mudstone	very dark grey, with dark grey horizontal silt interbeds, stiff, poorly indurated, can cut well with knife
10.06	11.58	1.60	1.32	Siltstone	dark grey, clayey, massive, soft, slightly calcareous
			0.05	Siltstone	dark grey, very fine-grained light grey horizontal sand lenses, non-calcareous
			0.08	Mudstone	very dark grey, massive, waxy, stiff, sharp lower contact along 2 mm carbonate lamination
			0.08	Sandstone	grey, very fine-grained, massive, non-calcareous
			0.15	Mudstone	very dark grey, horizontally bedded, silty, non-calcareous; TD at 11.58 m

Drill Site BHH02-03

Date *21-Aug-02*
Logged By *J. Pawlowicz*
Drill Company *Canadian Geological Drilling*
Driller *Ken Pearson*
Drill Type *MS-61 Auger Rig*
Location *Buffalo Head Hills*
LSD *5* **Sec** *32* **Tp** *90* **Rg** *11* **W** *5M*
Longitude *-115.72672° W* **Latitude** *56.84882° N* *NAD 83*
Ground elevation (m) *779* **Source** *approximated from 1:50 000 topographic maps*
Total depth (m) *11.6*
Conditions
Site Comments *UTM_E 577660, UTM_N 6301281, UTM Zone 11; 100 m north of the road in old cutblock clearing*

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
0.91	2.44	1.10	1.03	Till	dark brown, oxidized, clayey silt, massive, strongly calcareous, numerous rotten limestone and igneous clasts, minor grey shale clasts, minor quartzite and ironstone, moderately soft till, upper half of till is friable - lower half is soft and sticky
			0.07	Sand	brown, oxidized, horizontally bedded, medium-grained with minor pebbles up to 0.5 cm, sharp contact with till above
2.44	3.96	1.10	0.05	Sand	same as above, brown, coarse-grained, glacial: igneous and quartzite granules; loose, abrupt lower contact
			0.81	Till	dark brown, oxidized, sandy, clayey silt, massive, strongly calcareous, soft, friable; igneous, rotten limestone, quartzite, ironstone and minor black shale clasts; gypsum-filled fracture in lower 10 cm.
			0.19	Mudstone	silty, dark brown and orange-brown, strongly oxidized, horizontally bedded, moderately calcareous, abrupt contact with till above
			0.05	Sandstone	very fine-grained, clayey, horizontally bedded, orange-brown, strongly oxidized
3.96	5.49	1.33	0.33	Sandstone	fine-grained, massive, unconsolidated, orange-brown, strongly oxidized
			0.07	Sandstone	fine-grained, olive grey with horizontal carbonaceous laminae
			0.27	Siltstone	clayey siltstone interbeds, horizontally bedded, olive and orange-brown, strongly oxidized interbeds, poorly consolidated
			0.66	Mudstone	horizontally bedded, siltstone interbeds, brown, orange-brown strongly oxidized beds, minor unoxidized light grey beds, minor carbonaceous laminae

Drill Site BHH02-03

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
5.49	7.01	1.23	0.30	Sandstone	very fine-grained, brown, oxidized, horizontally bedded, siltstone interbeds, minor horizontal carbonaceous laminae
			0.75	Mudstone	minor sandstone interbeds, silty, horizontally bedded carbonaceous laminae, brown and olive brown, strongly oxidized beds, moderately stiff, moderately calcareous
			0.45	Sandstone	brown and orange-brown, strongly oxidized beds, carbonaceous laminae, horizontal mudstone interbeds, non-calcareous
7.01	8.53	1.55	0.75	Sandstone	same as above, fine-grained, horizontal mudstone interbeds, brown carbonaceous laminae, poorly consolidated, non-calcareous
			0.80	Mudstone	horizontally bedded, silty, siltstone and minor fine-grained sandstone interbeds, brown carbonaceous laminae, brown and orange-brown, strongly oxidized, vertical fractures, non-calcareous
8.53	10.06	1.42	1.20	Sandstone	very fine-grained, brown, oxidized, horizontally bedded with minor dark grey-brown mudstone interbeds, carbonaceous laminae, poorly consolidated, strongly oxidized bedding planes
8.52			0.22	Mudstone	silty, horizontally bedded with carbonaceous laminae, strongly oxidized along horizontal bedding planes, very stiff
10.06	11.58	1.35	0.20	Siltstone	grey-brown, oxidized, horizontally bedded, friable, non-calcareous
			1.15	Mudstone	horizontally bedded, very dark brown, minor orange-brown interbeds, moderately oxidized with carbonaceous laminae, abundant silty interbeds, minor carbonaceous laminae; TD at 11.58 m

Drill Site BHH02-04

Date *22-Aug-02*
Logged By *J. Pawlowicz*
Drill Company *Canadian Geological Drilling*
Driller *Ken Pearson*
Drill Type *MS-61 Auger Rig*
Location *Buffalo Head Hills*
LSD *6* **Sec** *31* **Tp** *90* **Rg** *11* **W** *5M*
Longitude *-115.74672° W* **Latitude** *56. 849° N* *NAD 83*
Ground elevation (m) *758* **Source** *approximated from 1:50 000 topographic maps*
Total depth (m) *11.9*
Conditions *sunny, warm*
Site Comments *UTM_E 576440, UTM_N 6301278, UTM Zone 11; 2 km west of K4 kimberlite, clearing next to road*

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
0	0.91	0		Till	stony, drilled down to core point
0.91	2.44	0.84	0.30	Till	dark brown, slightly calcareous, slightly oxidized, sandy, clayey silt, massive, stiff, clasts (3%): igneous, limestone; B-soil horizon
			0.02	Sand	fine-grained, olive brown
			0.52	Till	C-soil horizon, dark grey-brown, clasts: ironstone, igneous, limestone, local sandstone; strongly calcareous
2.44	3.96	0.74	0.74	Till	same as above, core ribboned/deformed from pushing stone during drilling
3.96	4.27	0.20	6.20	Boulder	gravely sand, large stones, 10 cm gneiss, quartzite and igneous clasts, coarse-grained oxidized sand, difficult drilling
4.27	4.57	0.30	0.33	Sand and gravel	stones up to 10 cm, coarse-grained sand, orange-brown, clasts: Athabasca sandstone, quartzite, igneous, gneiss
4.57	5.49	0.55	0.55	Sand and gravel	loose, orange-brown, strongly oxidized, saturated, pebbles to 5 cm: igneous, quartzite and gneiss clasts; very coarse-grained sand, easy drilling 4.57 to 5.49 m
5.49	7.01	0		Sand and gravel	drilled through sand and gravel - same as before very clean - good aquifer - zero recovery
7.01	8.53	1.45	1.45	Sand and gravel	medium to coarse-grained sand, saturated, horizontal bedding in bottom 20 cm (with 1 cm dark grey till layers), fewer large stones, clasts: igneous, quartzite, Athabasca sandstone; loose, oxidized, brown, strongly oxidized bed near base
8.53	10.06	1.52	1.42	Sand and gravel	as above, rounded and angular clasts to 3 cm, minor unoxidized grey till layers < 1 cm thick
			0.10	Sand and gravel	grey-brown, slightly oxidized, coarse-grained sand, clayey, pebbles to 3 cm, rotten white limestone, clasts: igneous, quartzite, Athabasca sandstone

Drill Site BHH02-04

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
10.06	11.89	0.86	0.86	Sand	coarse-grained, oxidized, brown, less oxidized grey-brown at base, glacial clasts: igneous, quartzite, chert; pebbles to 4 cm ~ drilling very difficult - sand filling hole, TD at 11.89 m

Drill Site BHH02-05

Date *22-Aug-02*
Logged By *J. Pawlowicz*
Drill Company *Canadian Geological Drilling*
Driller *Ken Pearson*
Drill Type *MS-61 Auger Rig*
Location *Buffalo Head Hills*
LSD *2* **Sec** *32* **Tp** *90* **Rg** *11* **W** *5M*
Longitude *-115.71506° W* **Latitude** *56.84596° N* *NAD 83*
Ground elevation (m) *761* **Source** *approximated from 1:50 000 topographic maps*
Total depth (m) *13.1*
Conditions
Site Comments *UTM_E 578377, UTM_N 6300975,UTM Zone 11; clearing next to road on cutline leading to K4 kimberlite*

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
0	0.91	0		Till	drilled through, no recovery
0.91	2.44	1.52	1.52	Till	mottled dark grey-brown and dark brown, oxidized, massive, clayey silt matrix with sand zones, strongly calcareous except top 5 cm, stiff, 2% clasts: rotten limestone, igneous, ironstone, quartzite and minor black shale clasts
2.44	3.96	1.52	0.41	Till	as above, mottled and very stiff
			1.11	Till	grey-brown with black, orangish brown and brown coloured horizontal fracture zones, strongly calcareous
3.96	5.49	1.53	0.35	Till	dark olive-brown, oxidized, same till as above, very dark brown tabular shale/mudstone clasts (1 cm), strongly calcareous
			1.10	Till	very dark grey-brown, slightly oxidized with strongly oxidized high-angle joints, silty clay, very plastic, massive, strongly calcareous, clasts: igneous, ironstone, quartzite and minor black shale
			0.08	Till	very dark grey, very moist, clayey, unoxidized
5.49	7.01	1.17	0.13	Mudstone	very dark grey, minor dark olive grey mottled, massive, soft, non-calcareous
			0.30	Siltstone	dark olive grey, clayey, oxidized, massive, friable, broken, non-calcareous
			0.56	Mudstone	very dark grey, grey silty interbeds, horizontally bedded, minor dark olive grey oxidized beds, base of weathering, moderately stiff
			0.15	Mudstone	unoxidized, very dark grey, silty, very stiff, non-calcareous
7.01	8.53	1.47	1.47	Mudstone	very dark grey, horizontal bedding, light grey silty laminae, very waxy lower 30 cm - possibly bentonitic, non-calcareous, unoxidized
8.53	10.06	1.45	1.45	Mudstone	very dark grey, same as above, massive appearance, faintly deformed light grey silty laminae, bioturbated, non-calcareous, stiff, easily cut with knife

Drill Site BHH02-05

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
10.06	11.58	1.43	1.43	Mudstone	as above
11.58	13.11	1.49	1.49	Mudstone	minor sandstone laminae, broken from drilling, similar to above; TD at 13.11 m

Drill Site BHH02-06

Date *23-Aug-02*
Logged By *J. Pawlowicz*
Drill Company *Canadian Geological drilling*
Driller *Pat Ross*
Drill Type *MS-61 Auger Rig*
Location *Buffalo Head Hills*
LSD *11* **Sec** *36* **Tp** *90* **Rg** *12* **W** *5M*
Longitude *-115.77412° W* **Latitude** *56.85269° N* *NAD 83*
Ground elevation (m) *751* **Source** *approximated from 1:50 000 topographic maps*
Total depth (m) *11.6*
Conditions
Site Comments *UTM_E 574761, UTM_N 6301658, UTM Zone 11; at junction of road and wide cutline*

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
0	0.91	0		Till	drilled through, no recovery
0.91	2.44	0.91	0.71	Till	dark grey-brown, strongly calcareous, silty clay, plastic, clasts: ironstone, rotten limestone and granites; core deformed from pushing stone in core shoe; abrupt contact with unit below
			0.20	Mudstone	olive brown, massive, deformed from drilling, oxidized, non-calcareous
2.44	3.96	1.31	0.91	Mudstone	olive grey, massive, fractured, strongly oxidized fractures, minor silt
			0.28	Mudstone	dark olive grey, horizontally bedded, silty laminae, strongly oxidized bedding planes, bedding mildly disrupted, non-calcareous
			0.12	Mudstone	very dark grey, horizontal silty laminae, minor oxidation, small ironstone concretions <0.5 cm
3.96	5.49	1.38	0.89	Mudstone	dark grey-brown, oxidized, massive, strongly oxidized fractures, non-calcareous
			0.20	Mudstone	very dark olive grey, massive, unoxidized, strongly oxidized horizontal 1 cm zones, plastic/stiff, minor 1 cm sand filled burrows, bioturbated?
			0.29	Mudstone	very dark grey, unoxidized faint horizontal silty laminae, stiff and plastic
5.49	7.01	1.37	0.05	Mudstone	dark grey, massive, stiff and plastic
			0.48	Siltstone	grey, massive, clayey, unoxidized, soft
			0.12	Sandstone	grey, fine-grained, 0.5 cm strongly indurated calcareous bed, water bearing
			0.72	Mudstone	dark grey, interbeds of grey siltstone and fine-grained sandstone, two buff coloured beds (2 cm thick), horizontally bedded

Drill Site BHH02-06

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
7.01	8.53	1.40	0.27	Siltstone	dark grey, massive, soft
			0.10	Sandstone	fine-grained, clayey, abrupt lower contact, gradational upper contact
			0.34	Siltstone	clayey and sandy interbeds, soft, minor buff-coloured beds (1 cm thick), very slightly calcareous
			0.69	Mudstone	very stiff, waxy, dark grey, minor silty interbeds near top, light grey clayey (bentonite?) and carbonaceous interbeds near base, non-calcareous
8.53	10.05	1.59	1.59	Mudstone	minor siltstone and sandstone interbeds, silty, non-calcareous, moderately soft, minor carbonaceous laminae near top of core, dark grey, massive
10.05	11.58	1.25	1.00	Mudstone	as above, dark grey, soft, massive, non-calcareous, broken from drilling
			0.10	Mudstone	very dark grey with black carbonaceous laminae
			0.13	Mudstone	very dark grey, waxy, horizontally bedded 0.5 cm buff-coloured bed
			0.02	Siltstone	dark grey, very hard, calcareous; TD at 11.58 m

Drill Site BHH02-07

Date *23-Aug-02*
Logged By *J. Pawlowicz*
Drill Company *Canadian Geological Drilling*
Driller *Pat Ross*
Drill Type *MS-61 Auger Rig*
Location *Buffalo Head Hills*
LSD *15* **Sec** *36* **Tp** *90* **Rg** *12* **W** *5M*
Longitude *-115.76936° W* **Latitude** *56.85508° N* *NAD 83*
Ground elevation (m) *774* **Source** *approximated from 1:50 000 topographic maps*
Total depth (m) *13.1*
Conditions
Site Comments *UTM_E 575047, UTM_N 6301929, UTM Zone 11; 400 m N of BHH02-6 on cutline*

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
0	0.91	0.76	0.05	Organic soil	
			0.08	Silt	light grey-brown, Ae soil horizon
			0.20	Clay	light grey-brown, silty clay, Ae to B transition
			0.43	Till	B-soil horizon, dark brown-grey, clayey silt, massive, non-calcareous, minor horizontal oxidization
0.91	2.44	1.43	0.03	Till	as above
			1.19	Till	C-soil horizon, strongly calcareous, dark grey-brown, clayey silt, friable, clasts: ironstone, igneous and quartzite; moderately oxidized
			0.21	Till	dark brown, oxidized, massive, few pebbles, silty, soft
2.44	3.96	1.52	1.29	Till	dark grey-brown, soft, three strongly oxidized sand lenses (1 cm thick each), massive, clasts: igneous, minor limestone and quartzite
			0.23	Till	moderately calcareous, horizontal dark grey-brown and dark brown bands reflecting oxidization along horizontal fractures, 3 cm oxidized sand lens at base
3.96	5.49	1.15	0.07	Till	dark grey-brown, minor sand lens, same as above
			0.08	Clay	silty, mottled dark grey-brown and brown, strongly oxidized
			0.38	Silt	saturated, mottled dark brown and dark orange-brown, strongly oxidized, loose
			0.30	Sand	orange-brown, strongly oxidized, medium to coarse-grained, minor pebbles to 4 cm, clasts: igneous and quartzite
			0.32	Till	black, slightly oxidized, silty clay, very stiff, strongly iron-oxidized horizontal fractures, non-calcareous

Drill Site BHH02-07

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
5.49	7.01	1.30	1.30	Till	black, silty clay, very stiff, hard, massive, non-calcareous, 1% pebbles and granules, clasts: black shale and grey sandstone cobble; no visible limestone; beds with concentrations of granules and olive-coloured clasts (weathered kimberlite?), non-calcareous
7.01	8.53	1.58	1.58	Till	same as above, black, very stiff, clayey, massive, unoxidized, few pebbles, numerous olive-rich bands and granules in till, greenish and white weathered (kimberlite?) clasts in olive bands dipping 20 to 30 degrees, minor kimberlite clasts throughout
8.53	10.05	1.52	0.75	Till	same as above but less olive-coloured kimberlite material, abrupt contact with unit below
			0.27	Sandstone	concretions, very hard, calcareous cement, dark grey with brown weathering rind, broken from drilling
			0.47	Sandstone	grey brown, slightly oxidized, very fine-grained, soft, poorly consolidated, moderately calcareous, fractures with minor offsets
10.05	11.58	1.52	0.10	Sandstone	carbonaceous laminae dipping 20 degrees, fine-grained, grey, sharp 20 degree contact with unit below
			0.70	Mudstone	dark grey and dark olive grey, bedded, slightly oxidized, one 1 cm thick strongly oxidized sand bed, siltstone interbeds
			0.72	Siltstone	dark grey, non-calcareous, unoxidized, 1 thin buff-coloured mudstone bed, some moderately hard layers, fractured
11.58	13.11	1.61	1.61	Siltstone	very dark grey, non-calcareous, interbeds of mudstone, coarsening up from mudstone to siltstone; TD at 13.11 m

Drill Site BHH02-08

Date *24-Aug-02*
Logged By *J. Pawlowicz*
Drill Company *Canadian Geological Drilling*
Driller *Pat Ross*
Drill Type *MS-61 Auger Rig*
Location *Buffalo Head Hills*
LSD *3* **Sec** *6* **Tp** *91* **Rg** *11* **W** *5M*
Longitude *-115.76539° W* **Latitude** *56.85736° N* *NAD 83*
Ground elevation (m) *786* **Source** *approximated from 1:50 000 topographic maps*
Total depth (m) *36.0*
Conditions *Sunny and clear*
Site Comments *UTM_E 575284, UTM_N 6302188, UTM Zone 11; 350 m NE of BHH02-7 along cutline on top of hill, numerous boulders to 1.3 m at surface*

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
0	0.91	0.74	0.02	Organic soil	black
			0.08	Silt	Ae, light grey
			0.30	Silt	light brown, massive, Ae/B soil transition, oxidized
			0.30	Till	clayey silt, dark brown, pebbles and granules, faint sub-horizontal banding, non-calcareous
0.91	1.22	0		Till	very poor recovery, pushing on rock, moved rig over 1 m and drilled 1.22 m to core point depth
1.22	2.44	1.34	1.34	Till	dark grey-brown, clayey silt, massive, oxidized, 4% granules: abundant limestone, igneous, ironstone, quartzite and minor black shale clasts; strongly calcareous, many rotten clasts, soft
2.44	3.05	1.07	0.72	Till	very dark grey-brown, soft, abundant carbonate, clasts as above including gneiss, mottled, strongly oxidized, gradational contact with unit below
			0.35	Sand	fining upwards, dark brown, oxidized, many granules, bedded
3.05	3.96	0			auger refusal on stone, drilled down with plug to core point
3.96	5.49	1.57	0.08	Till	dark grey-brown, clayey silt, massive, strongly calcareous, same till as above
			0.68	Till	grey, much lighter colour than till above, silty clay, non-calcareous, numerous high-angle strongly oxidized fractures, few clasts
			0.25	Till	soft and sticky, friable along fractures, minor tan-coloured clay rimmed fractures (peds?) - possible paleo Ae/B soil transition
			0.56	Till	clayey silt, very dark grey-brown, oxidized, strongly oxidized high-angle fractures, 1 - 2 mm thick iron oxide along fractures, very hard, massive, 2% granules: igneous, quartzite and ironstone clasts; no visible limestone; non-calcareous, minor black shale clasts and local sandstone clasts up to 2 cm

Drill Site BHH02-08

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
5.49	7.01	1.50	1.50	Till	same as above, very dark grey-brown, strongly oxidized along high-angle fractures and low-angle zones 2 cm thick, possible weathered kimberlite material - faint brown low-angle beds 1 cm thick; 3% granules, few pebbles: igneous, quartzite, ironstone and black shale clasts; non-calcareous, iron-cemented nodules and fractures make this till very hard, minor black unoxidized zones between fractures
7.01	8.53	1.06	0.56	Till	same as above, very dark grey-brown, strongly oxidized, non-calcareous, large broken clast - iron clay cemented quartz grains
			0.50	Till	same as above, very dark grey, unoxidized with strongly oxidized horizontal fractures, non-calcareous, very hard and dry
8.53	10.05	1.61	0.80	Till	same as above, very dark grey, unoxidized with strongly oxidized fracture zones and clasts to 10 cm, possible hard weathered till clasts that contain 2 mm granules in clayey matrix, till is dense, stiff, higher moisture than previous till, non-calcareous
10.05	11.58	0.81	0.81	Till	same as above, but unoxidized, no iron staining, stiff, dense and plastic, higher moisture content, clayey silt, few clasts (2%): igneous, quartzite, black carbonaceous mudstone and minor light grey silty clay clasts, non-calcareous
11.58	13.11	1.47	0.56	Till	same as above, unoxidized, dark grey, no iron staining, two oxidized sand lenses, zone of possible core loss
			0.31	Till	very dark grey with numerous strongly oxidized horizontal fractures, clasts: sandstone to 2 mm
13.11	14.63	1.59	1.59	Till	clayey silt, very dark grey, same as above, dense and plastic, non-calcareous, mostly unoxidized with brown oxidized horizontal beds that are silt and/or fractures, few clasts (< 2%): igneous, quartzite, black shale and minor pink shale clasts to 2 cm; one high-angle oxidized fracture near top
14.63	16.15	1.58	1.58	Till	very dark grey with abundant dark olive-grey oxidized vertical and horizontal zones (likely fractures), very stiff and dense, H2S odour, non-calcareous, 2% clasts: abundant local bedrock, black shale, laminated mudstones clasts and minor white limestone clasts (1st indicator of carbonates since top of hole)
16.15	17.68	1.60	1.32	Till	same as above, high-angle oxidized olive-brown fractures, clayey silt, minor fine-grained sand stringers
			0.28	Till	dark grey, 3% clasts: sandstone, quartzite and igneous; clayey silt, slightly calcareous, top 10 cm contains numerous strongly calcareous silt lenses, unoxidized, faint lighter grey colour banding, minor olive-grey oxidation
17.68	19.20	1.61	1.61	Till	very dark grey, same as above, slightly calcareous, clayey silt, unoxidized, minor oxidization zones, 1 olive green clast - 2 cm (likely kimberlite), minor sulphides (marcasite), minor white limestone clasts, hard dark grey siltstone clasts, stiff and dense, minor sand lenses

Drill Site BHH02-08

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
19.20	20.78	1.61	1.61	Till	same as above, very dark grey, slightly calcareous, massive, stiff, clayey silt, minor silt stringers, unoxidized with mottled dark olive grey oxidation (marble looking), 1 clast - 1 cm grey with white mottling - ash clast?,other clasts: igneous, quartzite and shale; pink sand lens near bottom of core
20.78	22.25	1.58	1.58	Till	same as above, minor olive-brown oxidized zones, minor sulphide, minor black carbonaceous bands with fine-grained pink sand lens, clasts (1%): igneous, quartzite and shale; minor light grey silt stringers, slightly calcareous
22.25	23.78	1.45	1.45	Till	same as above, very dark grey, slightly calcareous, unoxidized, one horizontal olive green oxidized fracture, clasts: Athabasca sandstone, minor igneous, quartzite and black shale; 15 cm pink sand bed near top, minor light grey silt, minor sulphides, minor green clasts (kimberlite?)
23.78	25.30	1.60	1.60	Till	same as above, unoxidized, slightly calcareous, light grey silt stringers, pink sand lenses, sample taken of 4 cm olive green soft clast found in base of core, 2 cm medium-grained grey saturated sand lens near bottom, clasts: igneous, quartzite, chert, shale and minor white limestone; one 6 cm clast of carbonate-cemented siltstone
25.30	26.82	1.26	1.26	Till	continuation of green clast in top 5 cm of core, minor sulphides, igneous, shale, minor white limestone, black chert and quartzite clasts, minor grey sand lenses, slightly calcareous, olive green clast at bottom of core
26.82	28.37	1.60	0.60	Till	silty, sandy, moderately calcareous, fine-grained interbeds of grey sand/silt
			1.00	Till	silty clay, non-calcareous, very dark grey, more clay than till above, light grey silt stringers, chert, igneous, Athabasca sandstone, minor ironstone, minor white friable carbonaceous, minor olive green kimberlite and minor suplide clasts
28.37	29.87	1.60	0.10	Till	same as above, non-calcareous
			0.53	Till	dark grey, silty, same till but slightly siltier and slightly calcareous
			0.50	Till	same as above, non-calcareous to slightly calcareous, laminated silty mudstone clasts, igneous, Athabasca sandstone and quartzite clasts; 2% granules
29.87	31.39	0.91	0.91	Till	silty clay, very dark grey, abundant black shale clasts, till matrix is non-calcareous but contains white calcareous blebs, same as above, massive
31.39	32.92	1.57	1.57	Till	core twisted and deformed from drilling, very dark grey, massive, stiff, non-calcareous, clayey silt, sulphide nodules, minor olive oxidized fracture zones, unoxidized matrix, minor sandy till bands (soft), small white calcareous silt clasts, 2% clasts: igneous, quartzite, black shale, minor brown siltstone and Athabasca sandstone

Drill Site BHH02-08

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
32.92	34.44	1.57	0.08	Till	same as above
			0.42	Sand	fine-grained, grey, saturated, oxidized vertical fractures, diamicton interbeds, loose, soft, non-calcareous, minor pebbles
			1.07	Till	same as above, clayey silt, massive, unoxidized very dark grey, numerous olive-brown oxidized zones, clasts: igneous, quartz, Athabasca sandstone, black shale, minor sulphide and minor small white calcareous (shell?) clasts; stiff and dense, faint horizontal banding
34.44	35.96	0.44	0.40	Sand	grey, medium to coarse-grained, well sorted, saturated, clean, one till bed 5 cm thick
			0.04	Till	same as above; auger refusal in wet sand - TD at 35.96 m

Drill Site BHH02-09

Date *25-Aug-02*
Logged By *J. Pawlowicz*
Drill Company *Canadian Geological Drilling*
Driller *Pat Ross*
Drill Type *MS-61 Auger Rig*
Location *Buffalo Head Hills*
LSD *8* **Sec** *36* **Tp** *90* **Rg** *12* **W** *5M*
Longitude *-115. 7633° W* **Latitude** *56.84675° N* *NAD 83*
Ground elevation (m) *738* **Source** *approximated from 1:50 000 topographic maps*
Total depth (m) *16.2*
Conditions
Site Comments *UTM_E 575433, UTM_N 6301009, UTM Zone 11; low-lying clearing next to road adjacent to glacial meltwater channel*

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
0	1.53	0		Sand and gravel	drill cuttings, brown, oxidized, medium to coarse-grained sand, clasts: quartzite, igneous and limestone
1.53	2.44	0		Till	drill cuttings, brown, oxidized, clayey silt, non-calcareous, drilled to core point - 2.4 m
2.44	3.96	1.22	0.50	Till	olive-brown, strongly oxidized, clayey silt, massive, strongly calcareous, clasts: carbonaceous, igneous, limestone and quartzite
			0.72	Sand and silt	sand and silt with till interbeds, brown strongly oxidized, bedded horizontally, numerous granules and pebbles, strongly calcareous
3.96	5.49	1.32	1.32	Sand	brown, medium to coarse-grained, saturated, loose, oxidized, clasts: chert, igneous, quartzite and limestone; minor brown silty clay interbeds
5.49	7.01	1.51	1.24	Sand	as above, brown, strongly oxidized, well sorted
			0.01	Clay	sandy, horizontal bedding, dark brown, moderately oxidized
			0.22	Sand	dark brown, moderately oxidized, horizontal interbedded medium and coarse-grained sand, clasts: quartzite, igneous and shale
			0.04	Sand and gravel	brownish grey, unoxidized, poorly sorted, angular clasts to 4 cm, quartzite and igneous clasts
7.01	8.53	1.52	1.52	Sand	gravely, oxidized, brown, poorly sorted, pebbles to 2 cm, minor beds of grey unoxidized sandy clay, clasts: igneous, quartzite, black shale, chert and ironstone
8.53	10.06	1.60	1.60	Silt	clay interbeds, grey, silt beds calcareous in upper 80 cm becoming non-calcareous at bottom, horizontally bedded, unoxidized, very soft and sticky, moist

Drill Site BHH02-09

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
10.06	11.58	1.60	0.44	Mudstone	dark orange, light grey silty horizontally bedded laminae, soft, sticky
			0.05	Gravel	glacial - clasts: igneous, Athabasca sandstone and quartzite; pebbles to 2 cm embedded in grey clay matrix, unoxidized
			1.11	Mudstone	same as above
11.58	13.11	1.60	1.60	Siltstone	interbedded with very fine-grained sand and mudstone laminae, horizontally bedded, unoxidized, grey, non-calcareous, small clast of possible amber, minor olive-grey oxidized beds, minor black carbonaceous laminae, very soft, faint sulphur odour upon application of HCl, shell fragments
13.11	14.63	1.55	1.55	Siltstone	dark grey, clayey, horizontally bedded, minor mudstone interbeds and fine to medium-grained dark greenish grey sandstone, non-calcareous, moderately stiff
14.63	16.15	1.60	1.60	Mudstone	dark grey, silty, horizontal bedding, numerous light grey silt and very fine-grained sand laminae, minor dark green fine-grained sand laminae, unoxidized, soft, non-calcareous; TD at 16.15 m

Drill Site BHH02-10

Date *23-Aug-02*
Logged By *J. Pawlowicz*
Drill Company *Canadian Geological Drilling*
Driller *Pat Ross*
Drill Type *MS-61 Auger Rig*
Location *Buffalo Head Hills*
LSD *8* **Sec** *30* **Tp** *91* **Rg** *12* **W** *5M*
Longitude *-115.91081° W* **Latitude** *56.92068° N* *NAD 83*
Ground elevation (m) *781* **Source** *approximated from 1:50 000 topographic maps*
Total depth (m) *23.8*
Conditions
Site Comments *UTM_E 566305, UTM_N 6309085, UTM Zone 11; old wellsite south of Husky plant, Sawn Lake area*

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
0	0.91	1.00	0.06	Topsoil	Ae-soil horizon
			0.94	Till	grey-brown, B-soil horizon, massive, non-calcareous, clasts: strongly oxidized local sandstone, igneous, quartzite and black shale; sandy silt, moderately oxidized
0.91	2.44	1.60	1.58	Till	dark brown, abundant local weathered bedrock - mudstone, siltstone, numerous rotten limestone clasts, strongly calcareous, soft, rootlets, massive, 1% clasts: igneous, quartzite, chert and black shale; minor strongly oxidized horizontal fractures
			0.02	Sand	coarse-grained, brown, oxidized
2.44	3.96	1.54	0.04	Sand	same as above
			1.50	Till	grey-brown, soft, same as above, slightly higher clast content - 2%, grey unoxidized root zones; minor dark grey shale
3.96	5.48	1.62	0.60	Till	same as above, grey-brown, soft, moderately oxidized, strongly calcareous
			1.02	Till	brown, slightly calcareous, strongly oxidized, minor grey unoxidized mottled zones and 8 cm strongly oxidized local sandstone clast, appears to be richer in local bedrock, clasts: igneous, quartzite, brown shale and ironstone, no visible limestone
5.48	7.01	1.57	1.04	Till	same as above, fewer clasts, strongly oxidized vertical fractures, minor coal clasts
			0.53	Till	dark grey-brown, slightly oxidized, clayey silt, minor dark olive-brown horizontal oxidized zones, non-calcareous, clasts: igneous, quartzite, ironstone and very dark grey mudstone, no limestone; stiff, massive
7.01	8.53	1.60	1.60	Till	non-calcareous, oxidized along vertical and horizontal joint zones, less oxidized with depth, dark grey and dark olive grey, moist, friable, massive, numerous dark grey shale clasts, minor white limestone clasts, a few pebbles, numerous rotten clasts, one strongly oxidized 2 mm sand stringer

Drill Site BHH02-10

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
8.53	10.05	1.60	0.30	Till	same as above, end of olive mottling
			1.30	Till	dark grey, unoxidized, dense, abundant local bedrock - black shale and brown mudstone (clasts to 5 mm), non-calcareous, massive, stiffer than above, clayey silt, 1% clasts: igneous, quartzite, one olive fine-grained 1 cm clast (possible olivine) at base of interval and grey calcareous siltstone
10.05	11.58	1.60	1.60	Till	same as above, small shell fragment, 3 cm sulphide (marcasite?), very dense one green/grey laminated cemented sandstone, minor carbonate clasts, abundant shale
11.58	13.10	1.32	1.32	Till	dark grey, same as above except slightly calcareous, abundant black shale clasts to 3 cm, one horizontal sand stringer, minor brown carbonaceous mudstone, minor limestone, massive, dense, stiff, clayey silt
13.10	14.60	1.43	0.76	Till	same as above, silt and fine-grained sand lenses (probable core loss in this interval), unoxidized, loose
			0.60	Till	same as above, small sulphite nodule, very few clasts (<1%) consisting mostly of shale
14.60	16.15	1.52	1.52	Till	same as above, shale clasts, calcareous sandstone - tabular approximately 2 cm, dolomite clast, few sand/silt lenses
16.15	17.68	1.60	1.60	Till	same as above, still very dense, slightly sandier, abundant black shale, small limestone clasts, very sticky, moist, sulphide nodules, very few other clasts (<1%): igneous and quartzite
17.68	19.20	1.60	1.60	Till	same as above, very weak reaction to HCl, dark grey, softer (possibly due to water content), 1 mm sand lenses - horizontal, still uniformly grey core, slightly deformed as pushing 8 cm gneiss and 6 cm Athabasca sandstone in core barrel shoe
19.20	20.70	1.60	1.20	Till	same as above except increase in cobbles >3 cm (consisting of igneous and sandstone clasts), 1 - 3 mm fine to medium-grained sub-horizontal sand lens, one carbonaceous siltstone >10 cm, 1 - 3 mm gravely sand bed, numerous light grey silt laminae
			0.10	Silt	grey with light grey silt laminae
			0.30	Till	same as above, small sand lens at bottom, non-calcareous, soft, sticky
20.70	22.30	0.90	0.65	Sand	likely core loss here, grey unoxidized, medium to coarse-grained, absence of clasts
			0.25	Sand	gradational contact with unit above, till/clay lenses within, numerous 1 to 2 cm clasts
22.30	23.80	1.30	0.40	Sand	grey, medium-grained, well sorted
			0.90	Till	dark grey, stiff, one coarse-grained sand lens at top of unit, same as above sand unit although stiffer, dense, less sticky, clasts: abundant black shale up to 3 cm, igneous, gneiss, limestone and brown mudstone; numerous light grey silt stringers, clayey silt, small sulphide clast, TD at 23.8 m

Drill Site BHH02-11

Date *26-Aug-02*
Logged By *J. Pawlowicz*
Drill Company *Canadian Geological Drilling*
Driller *Pat Ross*
Drill Type *MS-61 Auger Rig*
Location *Buffalo Head Hills*
LSD *8* **Sec** *10* **Tp** *91* **Rg** *12* **W** *5M*
Longitude *-115.83038° W* **Latitude** *56.87619° N* *NAD 83*
Ground elevation (m) *796* **Source** *approximated from 1:50 000 topographic maps*
Total depth (m) *43.6*
Conditions *sunny, warm*
Site Comments *UTM_E 571286, UTM_N 6304213, UTM Zone 11; clearing on east side of road, 500 m south of Husky camp*

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
0	0.91	0.67	0.30	Fill	
			0.10	Organic soil	
			0.27	Till	grey-brown, moderately oxidized, strongly calcareous, abundant rotten limestone, horizontal fissility (drilling function?) sandy silt, clasts: limestone, ironstone, quartzite and igneous; rootlets
0.91	2.44	0.50	0.50	Till	same as above, grey-brown with slight orange-brown mottling, sandy silt, clasts: limestone, ironstone, quartzite, and igneous, abundant limestone
2.44	3.96	1.60	1.60	Till	same as above, mottled grey-brown and orange-brown, strongly calcareous, clasts: igneous, limestone (clasts decreasing with depth), shale and local sandstone clasts; stiff, sandy silt, bottom 20% oxidized, 1-2 mm sand lens (orange) at 30 cm, some mottling appears to be concentrations of oxidation along fractures
3.96	5.48	1.60	0.35	Till	core deformed - twisted in drilling, grey-brown, same as above
			1.25	Till	dark brown-grey, sandy silt, moist, stiff and plastic, clasts (4%): quartzite, black shale, igneous and limestone; strongly calcareous, slightly oxidized with strongly oxidized vertical fractures
5.48	7.01	1.60	1.60	Till	dark grey, unoxidized, moderately calcareous, clayey silt, clasts: shale, quartzite, limestone, igneous and chert; soft, sticky, compact, orange/red oxidation on vertical fractures
7.01	8.53	0.95	0.45	Till	same as above, calcareous
			0.50	Sand	sharp contact with unit above, coarse-grained, grey, very well sorted, clasts: shield - igneous, quartzite, larger laminated clast; coarsening upwards from medium-grained sand, saturated; coring difficulties in sand
8.53	11.58	0		Sand and gravel	at 10.36 m hit gravel or a large cobble - difficult drilling, auger refusal at 12.2 m, bouldery, very stony, moved rig over to re-drill

Drill Site BHH02-11

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
11.58	12.19	0		Core loss	drill cuttings (collected from end of drill plug) - dark grey clayey silt, strongly calcareous, clasts: igneous, quartzite and sandstone
12.19	13.11	0		Core loss	drillers comments - possible till, drilled through clay with small pebbles, same as above
13.11	17.37	0		Core loss	drill cuttings - same as above, drilled to core point, interval from 11.58 to 17.37 m uncertain (possible till or stratified sediments)
17.37	19.20	1.52	0.75	Silt	dark grey-brown, clayey, unoxidized, distorted bedding, very soft, strongly calcareous, glaciolacustrine
			0.75	Clay	dark grey-brown, silty, unoxidized, strongly calcareous, very soft, distorted bedding, glaciolacustrine
19.20	20.73	1.57	1.57	Silt	dark brown-grey, rythmic bedding, clay beds coarsening up from 1 cm thick clay beds to 8 cm thick silt beds from 0.5 cm clay and 2 cm silt beds at base, strongly calcareous, glaciolacustrine
20.73	22.25	1.57	1.00	Silt	dark brown-grey, thick silty clay beds, strongly calcareous, 10 cm silty clay and 30 cm silt beds at top, 2 cm silty clay and 5 cm silt beds at base, coarsening up bedding, very soft
			0.57	Clay	dark brown-grey, thin rhythmic beds 0.5 cm clay - 2 cm silty clay, strongly calcareous, deformed beds in upper 30 cm, very soft
22.25	23.77	1.57	0.70	Clay	dark brown-grey, faint horizontal silty clay bedding, strongly calcareous, soft
			0.40	Silt	dark brown-grey, massive, strongly calcareous, gradational upper contact, abrupt lower contact, soft
			0.27	Clay	dark brown-grey, deformed silty clay beds, soft, strongly calcareous
			0.12	Sand	dark brown-grey, fine-grained, silty, horizontal bedding, strongly calcareous, loose
			0.08	Silt	dark brown-grey, clayey, horizontal bedding
23.77	25.30	1.30	0.67	Sand and gravel	dirty, unoxidized, gravely sand, calcareous, grey, clasts: igneous, limestone, quartzite and Athabasca sandstone
			0.63	Silt and clay	dark grey, interbedded silt and clay, similar to above, layers about 5 mm, one 5 cm clay layer
25.30	26.82	1.52	0.16	Sand, gravel and clay	mixed by drilling, dark grey, dirty gravel, sand and clay masses, calcareous, clasts: igneous, ironstone and coal
			0.94	Clay and silt	interbedded clay and silt, 1 - 5 mm laminae, calcareous, dark grey
			0.07	Diamicton	sandy silt with granules, sharp upper and lower contact, calcareous, dark grey
			0.35	Clay and silt	interbedded clay and silt as above, one 5 mm medium to very coarse-grained sand layer

Drill Site BHH02-11

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
26.82	28.35	1.52	0.15	Diamicton	diamicton 40%, clay 60%, mixed by drilling, dark grey, strongly calcareous
			0.15	Diamicton	silty sand, moderately calcareous, dark grey, granule-rich, massive, clasts: igneous, Athabasca sandstone, carbonate and abundant dark grey shale
			0.30	Clay and silt	interbedded, strongly calcareous, sharp upper contact, gradational lower contact
			0.50	Sand	grades upward from coarse to fine-grained, strongly calcareous, grey, gradational lower contact
			0.27	Clay/Sand	interbedded, sand (fine and coarse-grained layers) and one diamicton layer, all ~ 1 cm thick, dark grey, strongly calcareous
			0.15	Clay	silty clay, grey, moderately calcareous, one 1 cm silt layer at base, similar to silt and clay above
28.35	29.87	1.59	0.30	Silt and clay	dark grey, strongly calcareous, similar to above
			0.40	Clay	dark grey, strongly calcareous, similar to above
			0.19	Silt and clay	dark grey, 1-5 mm laminae, similar to above, strongly calcareous
			0.41	Clay	dark grey, similar to above, strongly calcareous
			0.23	Silt and clay	dark grey, 1-5 mm laminae, similar to above, strongly calcareous
			0.06	Till	olive-grey, moderately oxidized, non-calcareous - no HCl reaction, some iron-staining, sharp horizontal contact with overlying unoxidized dark grey clay, clasts: Athabasca Sandstone and shale
29.87	31.39	1.68	1.68	Till	silty, olive-grey, abundant iron staining on joints, non-calcareous, clasts: shale, granite and yellow Athabasca Sandstone or weathered quartzite
31.39	32.92	1.59	1.59	Till	similar to above except less oxidized, very firm, grey, non-calcareous, clayey silt, clasts: calcareous sandstone, grey shale, Athabasca sandstone, a few carbonate clasts, hard mudstone and one shell (inoceramus?) fragment; no iron-staining or oxidization
32.92	34.44	0		Till	likely till, boulder at 34.14 - 34.3 m, core slipped out of barrel
34.44	35.97	0.65	0.65	Till	dark grey, unoxidized, firm, non-calcareous, clayey silt, poor recovery due to 9 cm granite cobble stuck in shoe, clasts: igneous, shale, mudstone and Athabasca sandstone; massive
35.97	37.49	1.60	1.60	Till	same as above, dark grey, clayey silt, stiff and dense, clasts: igneous, quartzite, local sandstone, Athabasca sandstone and abundant black shale; majority of pebbles <1 cm, approximately 2% clasts, clast content increasing slightly with depth, sulphide nodule (<1 mm), small greenish clast (sandstone - glauconitic?) at base of core, one 6cm calcareous siltstone, clast size increasing with depth - several >3 cm clasts near bottom, additional 1 cm sulphide at bottom, massive

Drill Site BHH02-11

Drilled Depth (m) From	To	Core Recovery (m)	Described Interval (m)	Lithology	Comments
37.49	39.01	1.60	1.60	Till	same as above, dark grey, non-calcareous, abundant shale, shell fragments, small thin (<1 mm) sand lenses near top, same clasts as above, no sulphide noted, many clasts exceeding 1 cm, matrix is slightly siltier with more fine sand content
39.01	40.50	1.60	1.60	Till	same as above, dark grey, clast content same as above, less calcareous, siltstone and abundant black shale (50% of clasts), very stiff, dense and plastic, few granitics, many Athabasca sandstone
40.50	42.06	1.35	1.35	Till	clayey silt, dark grey, massive, clast content (<1%): mostly black shale up to 3 cm, igneous, quartzite and brown mudstone, same as above - very silty, less plastic; drillers comments: becoming harder to drill - bottom 1/3 pushing rock; core smaller in diameter
42.06	43.60	0			pushing rock 42.06 to 43.59 m, no recovery - TD at 43.6 m