

ARCSS074: SOIL DESCRIPTIONS AND SOIL CHEMISTRY
FOR LAII/ATLAS WINTER CARBON FLUX SITES, ALASKA,
1992 and 1998-2000

Project Title: Winter C-flux in arctic ecosystems under changing climate: Effects of soils carbon and active layer dynamics. This research was funded through the ATLAS program of the NSF, Arctic systems Science Program (NSF-OPP 9732731).

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Soil sampling at the ATLAS sites in Ivotuk and Council. Investigators included C.L. Ping and, G.J. Michaelson (UAF), J.M. Kimble (NRCS national Soil Survey Center), L. Everett (Ohio State Univ.) and A. Munule (EPA).

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SOIL DESCRIPTION AND CLASSIFICATION

Soil profile description and sampling protocol follow:

Soil Survey Division Staff. 1993. Soil Survey Manual. USDA Handbook No. 18. US Government Printing Office, Washington, D.C.

Soil Analysis follow:

Soil Survey Laboratory Staff. 1996. Soil Survey Laboratory Methods Manual. Soil Survey Investigation Report No. 42 Version 3.0. USDA-NRCS National Soil Survey Center. Lincoln, NE.

SITES AND MORPHOLOGICAL DESCRIPTIONS

101 – Site Name: Barrow Flux Tower

(50m east of the Ozone tower of the NOAA Station, BEO. South of Walter Oechel tower and west of D.A. Walker plot.) Sampling date: 8/10/98

Project: LAII-ATLAS Winter C-Flux Proj. C.L. Ping,

Location: Lat. 71° 19' 20" N; Long. 156° 36' 35.1" W.
 Landform: Beach terrace, nearly level.
 Parent material: loess over marine sediment
 Vegetation: wet tundra.
 Sampled by: C.L. Ping, G.J. Michaelson, and R.F. Paetzold

Table 1. Soil morphological properties.

Horizon	Depth cm	Color	Texture
Oi	0-3	7.5YR 2.5/2	peat
Oa	3-7	7.5YR 2.5/1	muck
Bg/Oajj	7-33	10YR4/3,4/4, 2.5Y 5/1 5YR 2.5/1, 2.5/2, 5Y 4/1	sandy loam (Bg) mucky sandy loam(Oajj)
Ab	33-35	10YR 2/1	mk silt loam
Oajj/2Cg	35-44	5YR 2.5/2, 5Y 3.5/1	muck (Oajj), loam (Cg)
2Cgf1	44-60	5Y 4/1, 4/2	Very gravelly loam(frozen)
2Cgf2/Wfm	60-90	2.5Y 5/1, 5/2	gravelly loam, 60% ice est.

Classification: Fine-loamy, mixed, superactive, pergelic Typic Aquiturbel

Comments: Glacial Aquiturbels may occur where ice wedges present within 1m of the soil surface.

102 – Site Name: Barrow BEO Sampling date: 8/19/92

Project: LAII-ATLAS Winter C-Flux Proj. C.L. Ping,
 USDA-NRCS/NSSL Soil ID#: S92AK-185-001, Sampled 8/19/92
 Landform: old drained-lake bed, nearly level.
 Parent material: lacustrine sediment
 Vegetation: tundra.
 Sampled by: J.M. Kimble, C.L. Ping, G.J. Michaelson, and K.R. Everett

Table 1. Soil morphological properties.

Depth Cm	Horizon	Description
0-7	Oe	Dark reddish brown (5YR3/2) peat, moderate medium platy structure, soft, nonsticky and nonplastic, common fine and medium roots throughout, 80% fiber unrubbed, 30% rubbed fiber, abrupt smooth boundary
7-17	Bw	Very dark grayish brown (10YR 3/2) silt loam, weak medium platy structure, slightly hard, friable, slightly sticky and slightly plastic, many fine and medium roots throughout, 7% well rounded shale-noncalcareous gravel, abrupt wavy boundary
17-30	Oa	60% black (10YR2/1) and 40% dark brown (7.5YR3/2) silt loam, weak medium platy structure, slightly hard, very friable, slightly sticky and nonplastic, few fine and medium roots throughout, abrupt irregular boundary
30-41	Oaf1	Dark reddish brown (5YR3/2) muck, massive, soft, nonsticky and nonplastic, few very fine and fine roots throughout, 40% fiber unrubbed, 0% fiber rubbed, clear smooth boundary
41-61	Cf1	Dark reddish brown (5YR3/2) muck, massive, soft, nonsticky and nonplastic, clear smooth boundary, many ice rich veins 3-5mm, material red but rapidly turns black (10YR2/1) upon exposure to air
61-97	Cf2	Dark grey (5Y4/1), weak prismatic structure, very friable, slightly sticky and slightly plastic, clear smooth boundary, has a net ice structure, ice lenses 2-3mm thick with soil aggregated between lenses, mineral soil welling up
97-100	Oaf2	Dark brown (7.5TR3/2) and very dark grayish brown (10YR3/2) muck, massive, few very fine and fine roots throughout, 5% well rounded shale-noncalcareous gravel, abrupt smooth boundary, many ice lenses <1mm thick with 5mm pockets of Oe material, this is in the organic material layer in trough of polygon

100+ Cf3 Dark gray (5Y4/1), weak massive, few very fine and fine roots throughout

Remarks: Udic moisture regime

Soil Classification: Coarse-loamy, mixed, superactive, pergelic, Ruptic Histoturbel

103 – Site Name: Barrow Central Marsh

Project: LAII-ATLAS Winter C-Flux Proj. C.L. Ping,

USDA-NRCS/NSSL Soil ID#: S92AK-185-003, Sampled 8/19/92

Location: Lat. 71° 18' 45" N; Long. 156° 35' 40" W.

Landform: Drained lake, nearly level.

Parent material: sediment

Vegetation: wet tundra.

Sampled by: C.L. Ping, G.J. Michaelson, and J.M. Kimble

Table 1. Soil morphological properties.

Depth Cm	Horizon	Description
0-11	Oi	Dark brown (7.5YR3/4) peat, common very fine roots throughout, and common medium throughout, abrupt smooth boundary
11-17	Cg	Grayish brown (2.5Y5/2) silt loam, massive, common very fine roots throughout and common medium throughout, 5% well rounded gravel, abrupt smooth boundary
17-20	Oib	Brown (7.5YR4/2) peat, turns black upon exposure to air, common very fine roots throughout and common medium throughout, abrupt smooth boundary
20-32	Oag/Cgf	60% dark brown (7.5YR3/4) and 40% dark grayish brown (2.5Y4/2), common fine roots throughout, 8% well rounded gravel, clear smooth boundary
32-48	Cfl	Dark grey (5Y4/1) gravely sandy loam, massive, 17% well rounded gravel

Remarks: Aquic moisture regime

Soil Classification: Coarse-loamy, mixed, superactive, pergelic Ruptic Historthel

104 – Site Name: Atqasuk

(near Skip Walker's vegetation plots southwest of the airstrip) Sampling date: 8/8/98

Project: LAII-ATLAS Winter C-Flux Proj., C.L. Ping,

Location: Lat. 70° 27' 55.5" N; Long. 157° 27' 02" W.

Landform: Outwash plain, nearly level with low tussocks of 15-18 cm across and 10 cm high.

Parent material: Sandy outwash.

Vegetation: Moist non-acidic tundra: Eriophorum spp., VAVI, LEDE, mosses and lichens

Sampled by: C.L. Ping, G.J. Michaelson

Table 1. Soil morphological properties.

Horizon	Depth cm	Color	Texture	Structure	Roots	Boundary
Oi	0-7	10Y5/3	Peat			as
Oe	7-10	10YR2/1, 7.5YR2.5/2	Mucky sand	single grain	3vf,f, 1m	
OA	10-35	7.5YR3/3, 10YR2/1	Mucky fine sand	1cpl & 1msbk	3vf,f	ai
Bw	35-51	10YR4/2, 2.5Y4/2 7.5YR3/3	Sand	massive	2f	as

Cgf1	51-68	2.5Y 4/1	Sand (frozen)	massive	1f dead roots	cs
Cgf2-Cgf4	68-105	2.5Y 4.5/1, 5/1	Sand	massive	1f dead roots	

Classification: Sandy, mixed, active, pergelic psammentic Aquorthel

Comments: The landform is more uniform and so are the soils. The soil horizons are nearly level or flat except some OA material sandwiched in the upper Bw horizon. Charcoal pockets scattered in Oe horizon. There is 20% rusty color (7.5YR) tonguing down. In Cf1 horizon there are vertical cracks with iron coatings (10YR3/3, 7.5YR3/3). The coatings extended into the upper part of Cf2. horizon.

105 – Site Name: Atqasuk

(south of Walter Oechel's tower at the east end of the airstrip)

Project: LAII-ATLAS Winter C-Flux Proj., C.L. Ping,

Sampling Date: 8/8/98

Location: Lat. 70° 28' 5.5" N; Long. 157° 24' 32" W.

Landform: Outwash plain, low center polygon, polygon rim next to Atqasuk-2.

Parent material: Sandy outwash

Vegetation: moist tundra, BENA, EMNI, VAVI, LEDE, Carex spp, Salix spp., Eriophorum spp.

Soil on eastside of pit:

Sampled by: C.L. Ping, G.J. Michaelson, and R.F. Paetzold

Table 1. Soil morphological properties.

Horizon	Depth cm	Texture
Oi	0-5	Peat
Oe	5-7	Muck
Ajj and C	7-32	Sand
C	32-60	Sand
Cf	60-100	Sand (frozen)

Classification: Sandy, mixed, superactive, pergelic Typic Psammenturbel

Comments: Surface organic and A&C horizons cryoturbated.

106 – Site Name: Atqasuk (northwest of W. Oechels tower E. of the airstrip)

Project: LAII-ATLAS Winter C-Flux, C.L. Ping

Sampling date: 8/9/98

Location: Lat. 70° 28' 14.4" N; Long. 157° 24' 27.9" W.

Landform: Outwash plain, low center polygon. Polygon rim.

Parent material: Sandy outwash

Vegetation: moist acidic tundra.

Sampled by: C.L. Ping, G.J. Michaelson, and R.F. Paetzold

Table 1. Soil morphological properties.

Horizon	Depth cm	Color	Texture	Structure	Roots	Boundary
Oe	0-5	7.5YR 3/3	mucky peat		3vf,f,lm	as
AC	5-12	10YR 4/3, 4/2	sand	single grain	3vf,f	aw
AB	12-18	7.5YR 3/2, 2.5Y 4/2	mucky sand	single grain	3vf,f	as
Bw	18-28	10YR 4/2	sand	single grain	3vf,f	aw
Ajj	28-50	10YR 3/2	sand	single grain	2vf,f	Ai
Objj	40-60	10YR 2/1	mucky sand	single grain	2vf,f	Ai
Cf/Oajj	60-80	2.5Y 4/1, 10YR 2/1	sand with frost-			

churned OM

Comments: Soils in the area east of the airstrip are more complex due to the formation of low-centered polygon. Soils in the flat center of the polygon are more uniform like those at the west end. But soils on the polygon rim are very complex due to cryoturbation.

Soil Classification: Sandy, mixed, superactive, pergelic Typic Umbriturbel

107 – Site Name: Oumalik - moist nonacidic tundra –

Walker vegetation plot: sampled July 10, 1999.

Project: LAII-ATLAS Winter C-Flux Proj., C.L. Ping,

USDA-NRCS Soils Data Base ID#: S99AK-185-006

Location: Lat. 68° 44' 07" N.; Long. 155° 51' 59.6" W.

Elevation:

Landform: Piedmont toeslope

Microrelief: Frostboils (inactive)

Slope: 3% SW convex

Drainage: poorly drained

Parent material: Residual sedimentary rocks

Sampled by: CL. Ping, G.J. Michaelson, J.M. Kimble, L. Everett and A. Munule

Table 1. Soil morphological properties.

Depth Cm	Horizon	Description
0-5	Oi	Litter layer; abrupt wavy boundary to
5-27	Bw	10YR3/3 (35%), 2.5Y3/2 (30%), 7.5YR4/6 (25%), and 10YR4/4 silty loam; weak, medium platy structure; friable when moist, slightly sticky and slightly plastic when wet; many very fine, fine, and few medium roots; clear smooth boundary to
27-46	Bg/Oajj	2.5Y3/2 (50%), 2.5Y4/2 (30%) silty loam and 10YR2/1 cryoturbated muck; weak medium platy structures; very friable when moist, slightly sticky and slightly plastic when wet; common very fine and fine roots; abrupt smooth boundary to
46-59	Bgf	5Y2.5/1 (40%). 10YR3/1 (20%) silty loam and 10YR3/2 (15%) and 10YR2/1 (5%) muck in streaks; reduced; Fe concentrations in 7.5YR4/4 (20%) around root linings and in mucky streaks; weak medium platy structures imbed with seasonally ice lenses; friable when moist and slightly sticky and slightly plastic when wet; common very fine and fine roots; abrupt smooth boundary to
59-67	Cf	5Y4/2 (60%), 5Y4/2 (25%) silt loam, and 10YR2/1 (15%) muck; reduced; massive, frozen; slightly sticky and slightly plastic when wet; ice net (vertical cracks) 2-3 cm apart and ice lenses 1-2 mm thick; few root remains; abrupt smooth boundary to
67+	Wfm	Ice wedge

Soil classification: Coarse-silty, mixed, superactive, pergelic Glacic Aquiturbel

Explanation: The soil keys into the Glacic subgroup because of the presence of ice wedge. It keys into the Aquic great group due to the reduced matrix in Bg and Cf and the redoximorphic features (mottles) in these two horizons. The Turbic suborder is due to the strongly cryoturbated Bg/Oajj horizon. The extent of ice wedges under this land cover type is not known but I suppose that not the whole unit is under ice wedges. Thus for areas without ice wedges or ground ice, the soils should be classified as Typic Aquiturbels.

108 – Site Name: Oumalik - acidic tundra

Walker vegetation plot: sampled July 10, 1999.

Project: LAII-ATLAS Winter C-Flux Proj., C.L. Ping,

USDA-NRCS Soils Data Base ID#: S99AK-185-005

Location: Lat. 68° 43' 58.8" N.; Long. 155° 51' 40" W.

Elevation:

Landform: Piedmont toeslope
 Microrelief: Tussocks
 Slope: 3% SW convex
 Drainage: poorly drained
 Parent material: Residual sedimentary rocks
 Sampled by: CL. Ping, G.J. Michaelson, J.M. Kimble, L. Everett and A. Munule

Table 1. Soil morphological properties.

Depth Cm	Horizon	Description
0-8	Oi	10YR4/3 peat; moss and Eriophorum roots; clear irregular boundary to
8-15	Oe/Oa	10YR2/1 mucky peat and 7.5YR2/0 muck; partially decomposed organic matter intermixed with muck; many very fine, fine and few medium roots; clear wavy boundary to
15-40	Bg	5Y4/2 (60%) and 2.5Y4/3 (25%) silty loam; 7.5YR4/6 and 10YR5/3 around root linings; strongly reduced; massive, wet; slightly plastic and slightly sticky; common fine roots; lower part of this horizon seasonally frozen and with some woody fragments; clear wavy boundary to
40-55	Oeb/Bgjj	10YR3/1 Oa; peaty muck; and 2.5Y4/2 silty loam; cryoturbated and reduced; seasonally frozen, missive, slightly plastic and slightly sticky; few fine roots and common medium root remains; abrupt smooth boundary to
55-75	Bgf	2.5Y3/2 silty loam amid ice matrix; frost-churned Oe material mostly from partially decomposed Eriophorum roots; few fine and many fine root remains in Bg and Oe materials, respectively; ice content >60% by volume.
75-100	Wfm/Bgf	

Soil classification: Fine-silty, mixed, superactive, pergelic Ruptic-Histic Aquiturbel

109 - Site Name: Ivotuk MAT - moist acidic tundra

Project: LAII-ATLAS Winter C-Flux Proj. C.L. Ping,
 USDA-NRCS/NSSL Soil ID#: S99AK-185-001, Sampled 7/8/99
 Location: Lat. 68° 29' 14.7" N.; Long. 155° 44' 22.7" W.
 Landform: Piedmont toe slope, Elevation: 543.1 m,
 Microrelief: Tussocks with frostboils
 Slope: 2.5%, azimuth: 115°
 Drainage: poorly drained
 Parent material: Residual sedimentary rocks
 Sampled by: CL. Ping, G.J. Michaelson, J.M. Kimble, L. Everett and A. Munule

Table 1: Soil profile morphological properties.

Depth Cm	Horizon	Description
0-22	Oi	5YR3/3 peat, tussock roots and moss layer; many fine and common medium roots; 5-35 cm thick; abrupt wavy boundary
0-41	Oe	7.5YR3/2 peaty muck, partially decomposed organic matter; many very fine, fine and few medium roots; common very fine, fine and few medium roots; 0-25 cm thick; abrupt wavy boundary
41-50	Bwjj	10YR4/4 (50%) matrix, 2.5Y5/2(30%), 2.5Y5/0 (10%) and 7.5YR4/6 in root linings; silty clay loam; massive (wet), sticky and plastic; few very fine and fine roots; 0-20 cm thick; clear gradual boundary
50-63	Bgjj	10YR4/1 (60%) matrix, 10YR4/4 (35%), 2.5Y5/1, 5/0 and 7.5YR4/4 Fe depletions and concentrations around common fine root channels and linings; clay loam, 7% round gravel; massive, wet, slightly plastic and slightly sticky; 5-20 cm thick; clear smooth boundary
63-100	Bg/Oajjf	75% Bg 10YR4/1 and 2.5Y5/1 clay loam, 25% Oa 10YR3/1 muck; massive, upper

permafrost; slightly plastic and slightly sticky; no roots.

Remarks: The upper permafrost appears at 63 cm based on soil morphology.
Soil Classification: Fine-loamy, mixed, superactive, pergelic Ruptic Histoturbel

110 - Site Name: Ivotuk Shrub

Project: LAII-ATLAS Winter C-Flux Proj., C.L. Ping,
USDA-NRCS/NSSL Soil ID#: S99AK-185-002, Sampled 7/7/99
Location: Lat. 68° 28' 52" N.; Long. 155° 44' 37.4" W.
Landform: Toe slope, Elevation: 544 m,
Microrelief: slightly undulating and concave.
Slope: 4.5%, Azimuth: 140°
Drainage: poorly drained
Parent material: Residual sedimentary rocks
Sampled by: CL. Ping, G.J. Michaelson, J.M. Kimble, L. Everett and A. Munule,

Table 1: Soil morphological properties.

Depth cm	Horizon	Profile Description
0-13	Oi	Peat; 5-10 cm thick; abrupt smooth boundary
13-20	Oe	5YR2.5/3 muck peat, occasional cobbles on surface; 2-10 cm thick; abrupt wavy boundary
20-30	Oa	7.5YR3/3 muck; 3-6 cm ice lenses amid the organic horizon; 5-15 cm thick; abrupt wavy boundary
30-60	Bg	2.5Y4/2 loam; medium to coarse platy structure; plastic and slightly sticky; seasonally frozen; 10% angular rock fragment; 20-30 cm thick; abrupt smooth boundary
60-85	Wfm/Bgf	Loam; 70% ice; mineral soil reduced; pockets of cryoturbated organic matter; 25 cm thick; abrupt irregular boundary
85+	Wfm	Ice wedge

Remarks: The undulating but continuous organic layers and the cryoturbated horizons key the soil into Histoturbel great group, and the presence of ice wedge or massive ground ice keys the soil into Glacic subgroup. However, the ice wedges are not expected to be continuous under the whole plot
Soil Classification: Fine-loamy, mixed, superactive, pergelic Glacic Histoturbel

111 - Site Name: Ivotuk MNT - moist nonacidic tundra

Project: LAII-ATLAS Winter C-Flux Proj., C.L. Ping,
USDA-NRCS/NSSL Soil ID#: S99AK-185-003, Sampled 7/7/99
Location: Lat. 68° 28' 43" N.; Long. 155° 43' 57" W.
Landform: Piedmont, Elevation: 544 m,
Microrelief: Solifluction lobe.
Slope: 5%, Azimuth: 115°
Drainage: well drained
Parent material: Residual metasedimentary rocks
Sampled by: CL. Ping, G.J. Michaelson, J.M. Kimble, L. Everett and A. Munule

Table 1: Soil morphological properties.

Depth cm	Horizon	Profile Description
0-5	Oi	Peat; many very fine, fine and medium roots; abrupt wavy boundary
5-40	Oe	5YR2.5/2 peaty muck, partially decomposed organic matter; many very fine, fine and medium roots; abrupt smooth boundary to

40-60	Bw	10YR3/3 gravelly loam (25% fractured sedimentary rock); weak, medium angular block structure; slightly plastic and slightly sticky; common very fine, fine, and few medium roots; at the top of this horizon there is a thin layer of flat rock fragments; abrupt smooth boundary
60-80	Cf	10YR2/1 very gravelly loam (40% fractured sedimentary rock fragments); massive, compact, slightly plastic and slightly sticky; ice lenses 1 mm thick about 2 cm apart

Remarks: The soil horizons show evidence of down slope movement due to solifluction. The sample was taken from the upper slope of the plot. The lower slope of the plot has a different microrelief; it is dominated by frostboils and it is common to have fragment of shale or slate frost-churned to the surface.
Soil Classification: Euic, pergelic Terric Hemistel

112 - Site Name: Ivotuk Moss - moist acidic tundra

Project: LAII-ATLAS Winter C-Flux Proj., C.L. Ping
 USDA-NRCS/NSSL Soil ID#: S99AK-185-004. Sampled 7/8/99
 Location: Lat. 68° 28' 51" N.; Long. 155° 44' 33.4" W.
 Landform: Piedmont, Elevation: 552.8 m,
 Microrelief: Tussocks.
 Slope: 1.2%, Azimuth: 312°
 Drainage: poorly drained
 Parent material: Residual sedimentary rocks
 Sampled by: CL. Ping, G.J. Michaelson, J.M. Kimble, L. Everett and A. Munule

Table 1: Soil morphological properties.

Depth cm	Horizon	Profile Description
0-10	Oi	5YR3/2 peat; many very fine, fine and few medium roots; abrupt clear boundary
10-30	Oe	7.5YR2.5/2 peaty muck; many very fine, fine and few medium roots; abrupt wavy boundary
30-50	Bg	10YR3/3 loam; fine reticular structure 3-5 mm thick; seasonal frozen, ice lenses 1-2 mm and vertical ice veins 2-3 mm thick; slightly plastic and slightly sticky; 10% cryoturbated organic matter; clear wavy boundary
50-68	Bg/Oabfjj	Bg 2.5Y3/3 gravelly loam; plastic and slightly sticky; 30% cryoturbated organic matter; 20% rock fragment with some rounded gravel; muck 10YR2/1 with segregated ice crystals in organics; 3-6 cm ice lenses amid the organic horizon; 5-15 cm thick
68+	Cf	Upper Permafrost

Soil Classification: Fine-loamy, mixed, superactive, pergelic Ruptic Histoturbel

113 – Site Name: Council - Tundra – sampled July 12, 1999.

Project: LAII-ATLAS Winter C-Flux Proj., C.L. Ping,
 USDA-NRCS Soils Data Base ID#: S99AK-180-003
 Location: Lat. 64° 50' 32.6" N.; Long. 163° 41' 39.2" W.
 Elevation:
 Landform: Flood plain
 Microrelief: hummocky with thermokarst
 Slope: 0-1%
 Drainage: Poor to very poor
 Parent material: alluvium

Sampled and described by: CL. Ping, X.Y. Dai, G.J. Michaelson, J.M. Kimble, L. Everett and A. Munule

Table 1. Soil morphological properties.

Depth cm	Horizon	Description
0-22	Oi	7.5YR3/3 peat; undecomposed moss and litters; many very fine, fine and medium roots; abrupt wavy boundary to
22-30	Oe1	2.5YR3/2 peaty muck; partially decomposed organic matter; many very fine, fine and common medium roots; abrupt wavy boundary to
30-52	Oe2	2.5YR3/2 muck; highly decomposed sedge residue; weak thin platy structure; few fine roots; abrupt smooth boundary to
52-68	Bgf	2.5Y3/2 silt loam; weak, thin lenticular structure; frozen, ice lenses 1-2 mm thick; sticky and plastic when wet; reduced; common fine root remains, few live Eriophorum roots; abrupt smooth boundary to
68-84	Oabf	5YR3/2 buried muck layer from decomposed Sphagnum; frozen with fine segregated ice crystals; abrupt smooth boundary to
84-100	Cf/Wfm	2.5Y3/2 silt loam; ice-rich (ataxitic horizon), >65% ice by volume; sticky and plastic when wet; 5% cryoturbated organic matter.

Soil classification: Dysic subgelic Fluvaquentic Hemistel

Explanation: This is a frozen organic soil. The soil is in the dysic family because it has an acidic reaction (moist acidic tundra). The mixed texture of hemic between 0-52 cm keys it into the Hemistel great group. The layer of silt loam at 52-68 cm suggests its fluvial origin.

114 – Site Name: Council - Open Shrub Site “Blueberry Hill”

Project: LAII-ATLAS Winter C-Flux Proj., C.L. Ping, sampled July 13, 1999.

USDA-NRCS Soils Data Base ID#: S99AK-180-004

Location: Lat. 64° 53’ 29” N.; Long. 163° 38’ 57.6” W.

Elevation:

Landform: Hills, shoulder slope

Microrelief: hummocky with frostboils

Slope: 20% SE facing

Drainage: Imperfect

Parent material: Colluvium

Sampled and described by: CL. Ping, X.Y. Dai and G.J. Michaelson

Table 1. Soil morphological properties.

Depth cm	Horizon	Description
0-25	Oi	10YR3/3 peat; undecomposed moss and litter; many very fine, fine and common medium roots; abrupt smooth boundary to (6-27 cm thick, with thicker part under Sphagnum moss and thinner part under sedge)
25-29	Oe	5YR2.5/1 muck; highly decomposed organic matter; weak, fine granular structure; very friable when moist, nonsticky and nonplastic when wet; many very fine, fine and common medium roots; abrupt wavy boundary to (3-7 cm thick)
29-33	A	2.5Y2.5/1 very gravely silty loam; weak, fine subangular structure; friable when moist, slightly stick and slightly plastic when wet; 65% channers and flat slate fragment; many very fine ,fine and few medium roots; abrupt irregular boundary to (0-4 cm thick)
33-50	Bg	5Y3/1 very gravely loam; saturated, slightly sticky and slightly plastic when wet; 15% Fe concentration 10YR4/4 around root channels; common fine and medium roots; 60% channers and flagstones; clear smooth

50-70	BCg	boundary to (5-15 cm thick) 5Y3/1 very gravely loam; moderate medium subangular blocky structure; weak medium lenticular structure in pockets; friable when moist and slightly sticky and slightly plastic when wet; common fine roots; 65% channers and flagstones; abrupt irregular boundary to (5-20 cm thick)
70-76	2Bwb	7.5YR3/4 fine sandy loam; buried horizon; moderate medium subangular and moderate medium platy structure; very friable when moist, nonsticky and nonplastic when wet; few fine and medium roots; common fine root channels; abrupt irregular boundary to (0-9 cm thick)
76-100	Bgb	5Y3/1 very gravely loam; buried horizon; moderate medium to coarse platy structure breaking into moderate medium subangular structure; friable when moist, slightly sticky and slightly plastic when wet; few fine medium roots, common root channels; >60% channers and flagstones, mostly slate.

Soil classification: Loamy-skeletal, mixed, superactive, frigid Histic Cryaquept

Explanation: The soil has a loamy family. It has a mixed mineralogy. It keys into the Inceptisol order and Aquic suborder because of the reduced matrix and redoximorphic features in the Bg horizon caused by episaturation. The soil keys into Cryaquept great group. This soil is polygenic because it shows evidence of frostboils and solifluction; the current surface is the result of frostboil and the buried horizons are due to solifluction.

115 – Site Name: Council Shrub

Project: LAII-ATLAS Winter C-Flux Proj., C.L. Ping, sampled July 13, 1999.

USDA-NRCS Soils Data Base ID#: S99AK-180-005

Location: Lat. 64° 56' 09" N.; Long. 163° 44' 14.6" W.

Elevation:

Landform: Hills, backslope, convex

Microrelief: plane

Slope:

Drainage: well-drained

Parent material: Residuum

Sampled and described by: CL. Ping, X.Y. Dai and G.J. Michaelson

Table 1. Soil morphological properties.

Depth cm	Horizon	Description
0-5	Oi	7.5YR3/3; peat; slightly decomposed litter; many very fine, fine, common medium and few coarse roots; abrupt smooth boundary to
5-11	Oa	10YR2/1 muck; highly decomposed organic matter; weak fine granular structure; friable when moist, nonsticky and nonplastic when wet; many very fine, fine and common medium roots; abrupt smooth boundary to
11-30	Bw	2.5Y4/2 loam; 20% mottles 10YR3/6 in masses; moderate thin lenticular structure; friable when moist, slightly sticky and slightly plastic when wet; common very fine, fine and few medium roots; 8% channers; clear wavy boundary to
30-50	BC	5Y3/2 loam; moderate thin platy structure breaking into moderate fine structure; friable when moist, slightly sticky and slightly plastic when wet; few fine roots; 10% cobbles; clear smooth boundary to
50+	2CR	2.5Y4/2 very channery sandy loam; soil filled in channer cracks; slightly sticky and slightly plastic when wet; 65% channers and most rock fragments has silt caps; few ice crystals in rock cracks due to seasonal frost.

Soil classification: Coarse-silty, mixed, superactive, frigid Lithic Eutrocrept

116 – Site Name: Council - Open Woodland Site

Project: LAII-ATLAS Winter C-Flux Proj., C.L. Ping, sampled July 12, 1999.

USDA-NRCS Soils Data Base ID#: S99AK-180-001

Location: Lat. 64° 53' 59" N.; Long. 163° 40' 01" W.

Elevation:

Landform: Back slope of rolling hills

Microrelief: slightly convex and undulating

Slope: 8% east-facing

Drainage: well drained

Parent material: Residual, mica-rich schist

Sampled by: CL. Ping, X.Y. Dai, G.J. Michaelson, J.M. Kimble, L. Everett and A. Munule

Table 1. Soil morphological properties.

Depth cm	Horizon	Description
0-2	Oi	7.5YR4/3 peat; least decomposed litter layer; 1-2 cm thick; abrupt smooth boundary to cm thick
2-8	Oa	2.5YR2.5/1 muck; highly decomposed organic matter; common very fine, fine and medium roots; 8-14 cm thick; abrupt smooth boundary to
8-19	Bw	5YR3/2 fine sandy loam; weak medium subangular blocky structure; friable when moist, nonsticky and nonplastic when wet; common very fine, fine and few medium roots; some fine pebbles at contact with the horizon below; abrupt wavy boundary to
19-37	BC1	2.5Y4/2 loam; 30% mottles 10YR4/6 in masses and root channels; weak medium platy structure; friable when moist, slightly sticky and slightly plastic when wet; few very fine and fine roots; clear smooth boundary to
37-60	BC2	2.5Y4/3 loam; weak fine lenticular structure with 20% fine ice lenses (seasonally frozen); firm when frozen, slightly sticky and slightly plastic when wet; few fine roots; 5% gravel; clear smooth boundary to
60-80	BC3	2.5Y 4/3 loam with 10% muck of 5YR3/2 and 7.5YR3/3; moderate medium lenticular structures with ice lenses 1-3 mm thick; firm when frozen, slightly sticky and slightly plastic when wet; abrupt smooth boundary to
80+	CR	Fractured bedrock (mica schist) with cracks filled with seasonally frozen loamy soils.

Soil classification: Coarse-loamy, mixed, superactive, frigid, Typic Dystocrypt

Remarks: The BC3 horizon has well developed cryogenic fabrics, i.e, lenticular structure. This suggest a past permafrost environment.

117 – Site Name: Council Forest Site

Project: LAII-ATLAS Winter C-Flux Proj., C.L. Ping, sampled July 12, 1999.

USDA-NRCS Soils Data Base ID#: S99AK-180-002

Location: (50 ft SW of Tower) Lat. 64° 54' 27" N.; Long. 163° 40' 24.5" W.

Elevation:

Landform: Back slope of rolling hills

Microrelief: slightly convex and undulating

Slope: 5% east-facing

Drainage: well drained

Parent material: Residual, mica-rich schist

Sampled and described by: CL. Ping, X.Y. Dai, G.J. Michaelson, J.M. Kimble, L. Everett and A. Munule

Table 1. Soil morphological properties.

Depth cm	Horizon	Description
0-11	Oi	7.5YR4/3 peat; undecomposed litter layer; many very fine, fine medium and few coarse roots; abrupt smooth boundary to
11-13	Oe	5YR2.5/2 mucky peat; partially decomposed organic matter; many very fine, fine and few medium and coarse roots; abrupt smooth boundary to
13-31	Oa	5YR2.5/1 muck; highly decomposed organic matter; common very fine, fine and few medium roots; abrupt smooth boundary to
31-57	Bw	7.5YR3/3 very fine sandy loam; weak thin platy structure; friable when moist, nonsticky and nonplastic when wet; common very fine and fine roots; 10% of the horizon intrudes into the underlying horizon along crack lines in wedge shape and this portion has strong lenticular structure; abrupt wavy boundary to
57-90	2C	2.5Y5/3 sandy loam; moderate medium lenticular structure; friable when moist, slightly sticky and slightly plastic when wet; few fine root remains; 10% gravel; clear smooth boundary to
90-110	2CR	2.5Y5/3 very gravelly sandy loam in cracks of fractured bed rock from angular and channery mica schist.

Soil classification: Coarse-loamy, mixed, superactive, frigid Andic Dystrocrept

Explanation: See Council Plot 1.

Remarks: This soil shows evidence of past permafrost as indicated by the well-developed cryogenic fabrics in 2C horizon.

118 – Site Name: Council - Barren Nonacidic

Project: LAII-ATLAS Winter C-Flux Proj., C.L. Ping,

Location: N64° 43.556' W 163° 56.688'

Elevation: 1200m

Landform: mountain saddle pass

Microrelief: slightly convex to flat

Slope: 5%

Drainage: well drained

Parent material: Residual, limestone

Sampled and described by: G.J. Michaelson 7/30/00

Table 1. Soil morphological properties.

Horizon	Depth cm	boundary	Color	Vol. % Fragments >2mm	Roots
A	0-3	Broken	5Y2.5/1	70 channers	2mf
AC	3-12	cs	5Y3/1	70 channers	2f
Cr	12-24	ai	5Y3/1	90 channers	1f

Soil classification: Fragmental, mixed, superactive, subgelic, Typic Cryorthent

Comments: surface rock or pavement acid weathered and darker colored on the upper exposed surfaces with carbonate deposits on the under side of rocks (to 1 cm thick). Pockets of fine materials are found under some cobble size flat stones.

119 - Site Name: Council - Barren Acidic

Project: LAII-ATLAS Winter C-Flux Proj., C.L. Ping,

Location: N 64° 43.560', W 163° 56.311'

Elevation: 1200m

Landform: mountain saddle pass

Microrelief: slightly convex to flat

Slope: 5%

Drainage: well drained

Parent material: Residual, micaceous schist

Sampled and described by: G.J. Michaelson 7/30/00

Table 1. Soil morphological properties.

Horizon	Depth cm	Boundary	Color	Vol. %Fragments >2mm	Roots
Oi	0-3	cw	2.5YR2.5/1		mcf
A	3-5	aw	5YR2.5/1	50 flat angular cobbles	mf
Bw	5-30	cs	10YR3/2	70 flat angular cobbles	mf
Oab	30-38	cs	10YR2/2	<10 flat angular cobbles	ff
Cr	38-60+		2.5Y7/6 ox. Stones: 10YR6/8	50 flat angular cobbles	None

Soil Classification: Loamy-skeletal, mixed, superactive, subgelic Typic Dystocryept

Comments: 30 cm diameter sorted circles over surface with relief of 5-10 cm, oxidation on upper surfaces of stones, Cr is residual decomposed schist bedrock.

120 – Site Name: Quartz Creek Tussock Tundra

Project: LAII-ATLAS Winter C-Flux Proj., C.L. Ping,

Location: - N65° 27.126', W 164° 37.709', Walker Tussock Tundra Grid at Mauze Creek (gridpoint A2,)

Elevation:

Landform: shoulder slope

Microrelief: convex-convex

Slope: 10%

Drainage: somewhat poorly drained

Parent material: loess, and colluvial and residual, micaceous schist/quartz

Sampled and described by: G.J. Michaelson 7/30/00

Table 1. Soil morphological properties.

Horizon	Depth cm	Color	Boundary	>2mm %	Structure	Consist.	Roots
Oi	0-4	10YR2.5/1	cw				3vff
Oe	4-10	10YR2.5/2	aw				3vff
Bw/Ajj	10-25	2.5YR4/1 5YR3/1	ci	<1%	gr	osop	2f
Bw/Oajj	25+	5Y4/1 7.5YR3/2 5Y2.5/4		<1%	pl	osop	1f

Soil Classification: Coarse-loamy, mixed, superactive, pergelic, Ruptic-Histic Aquiturbel

Comments: Seasonal frost at 24 cm, fine and medium roots proliferate at the contact of Oe and Bw horizons to form a mat. Vegetation: Eriophorum tussocks some low shrubs

121 - Site Name: Quartz Creek Lichen Stripe

Project: LAII-ATLAS Winter C-Flux Proj., C.L. Ping,
 Location: - Lichen stripe Walker Grid at Mauze Creek (gridpoint B4.)
 Elevation:
 Landform: hill slope, south-facing, lichen stripe or sorted circle centers
 Microrelief: convex-convex
 Slope: 8%
 Drainage: somewhat poorly drained
 Parent material: colluvial micaceous schist/quartz
 Sampled and described by: G.J. Michaelson 7/30/00

Table 1. Soil morphological properties.

Horizon	Depth cm	Color	Boundary	Redox features	>2mm %	Structure	Consist.	Roots
Oe/A	0-3	10YR2/2	cs					3vff
AB	3-8	10YR4/3 2.5Y5/2	cw		3	gr		2f
Bw	8-20	7.5YR5/8	ci		<1	gr		2f
Bg	20+	2.5YR4/4 5Y4/2,		2.5Y5/4	5	gr	sssp	2f

Soil Classification: Coarse-loamy, mixed, active, pergelic Typic Aquiturbel
 Comments: gravel concentration at mineral surface

122 – Site Name: Quartz Creek Inter-Stripe

shrubs, (inter-lichen area), Walker Grid at Mauze Creek (gridpoint B4.)

Project: LAII-ATLAS Winter C-Flux Proj., C.L. Ping,
 Elevation:
 Landform: hill slope, south-facing, between lichen stripe or sorted circle perimeters
 Microrelief: convex-convex
 Slope: 8%
 Drainage: moderately well drained
 Parent material: colluvial micaceous schist/quartz
 Sampled and described by: G.J. Michaelson 7/30/00

Table 1. Soil morphological properties.

Horizon	Depth cm	Color	Boundary	Redox features	>2mm %	Structure	Consist.	Roots
Oi/Oe	0-8	10YR2/2	cs					3vff
Bw1	8-20	10YR4/3	cs	Few	20 ang.	Granular		3f
Bw2	20-50+	10YR3/3		few	40 ang.	Granular		2f

Soil Classification: Loamy-skeletal, mixed, superactive, pergelic, Aquic Haploturbel
 Comments: more cobbles at surface compared with circle/stripe centers, shrubs and mosses dominate vegetation. Angular stones throughout profile.

123 – Site Name: Quartz Creek Shrub

Tall Shrub Site (grid point J6,) Location: N 65° 27.241', W 164° 37.912', Walker Shrub Grid at Mauze Creek (gridpoint J6,)

Project: LAII-ATLAS Winter C-Flux Proj., C.L. Ping,

Elevation:

Landform: slope drainage way

Microrelief: Alluvial fan

Slope: 20%

Drainage: well drained

Parent material: fluvial-colluvial micaceous schist/quartz and slope wash sediment

Sampled and described by: G.J. Michaelson 7/30/00

Table 1. Soil morphological properties.

Horizon	Depth cm	Color	Boundary	Redox features	>2mm %	Structure	Consist.	Roots
Oe	0-3	10YR2/2	as					3f
A	3-12	10YR4/3	ai			Gr	Smeary	2f
Bg1	12-20	2.5Y4/2	cs			Gr		2f
Bg2	20-30	2.5Y4/2	cs	10YR5/1 30% 10YR3/6 30%	10 ang.	Gr		2f
Bg3	30-80	2.5YR5/3	cs		4 ang.			1f
C1	80-85	2.5YR4/2	cs		10 ang.			1f
C2	85-100+							

Soil Classification: Loamy-skeletal, mixed, superactive, frigid, Typic Cryaquept

Comments: water seeping on top of C1. The C2 is compacted and dry. Salix shrubs 1-1.5 m tall forming large areas (5 m diameter) of closed canopy shrubs openings of 1 m scattered. The A horizon is smeary and appears to be high in volcanic ash derived material.

124 – Site Name: Quartz Creek Shrub-Tussock Tundra Interface

Mauze Creek solifluction zone

Project: LAII-ATLAS Winter C-Flux Proj., C.L. Ping,

Location: N 65° 27.253', W 164° 37.811', Walker Shrub Grid at Mauze Creek

Elevation:

Landform: hillslope

Microrelief: solifluction lobe 50 m diameter

Slope: 10%

Drainage: somewhat poorly drained

Parent material: loess and micaceous schist/quartz

Sampled and described by: G.J. Michaelson 7/31/00

Table 1. Soil morphological properties.

Horizon	Depth cm	Color	Boundary	Redox features	>2mm %	Structure	Consist.	Roots
Oi	0-15	10YR3/4						3fvf
Oa	15-18	10YR3/1						3fvf

A	18-25	2.5Y4/1	7.5YR4/4			smeary	3f
Bg	25+	2.5Y6/1 10YR3/2			pl		1f

Soil Classification: Fine-loamy, mixed, superactive, subgelic Typic Histoturbel

Comments: open shrub (1-10 m apart) to tussock tundra transition zone above shrub drainage ways.

Seasonal frost at 30 cm. Charcoal found in pockets in OA horizon at contact of organic and mineral.

125 – Site Name: Quartz Creek Solifluction Lobe - Meadow

Project: LAII-ATLAS Winter C-Flux Proj., C.L. Ping,

Location: above Walker Shrub Grid at Mauze Creek

Elevation:

Landform: hillslope

Microrelief: very large solifluction lobe 50 m diameter above incised shrub drainage way

Slope: 10%

Drainage: poorly drained

Parent material: loess and micaceous schist/quartz

Sampled and described by: G.J. Michaelson 8/1/00

Table 1. Soil morphological properties.

Horizon	Depth cm	Color	Boundary	Redox features	>2mm %	Structure	Consist.	Roots
Oi/Oe	0-8	10YR3/3						
O/A	8-11	10YR3/1						
Bg	11-25+	5Y5/2 2.5Y5/3		10YR4/4				

Comments: carex moss meadow

Soil Classification: Fine-loamy, mixed, superactive, pergelic Typic Aquiturbel

126 – Site Name: Quartz Creek Solifluction Lobe - Buttrus End

Project: LAII-ATLAS Winter C-Flux Proj., C.L. Ping,

Location: above Walker Shrub Grid at Mauze Creek

Elevation:

Landform: hillslope lower buttrus end of large solifluction lobe

Microrelief: very large solifluction lobe 50 m diameter buttrus end above incised shrub drainage way

Slope: 30%

Drainage: poorly drained

Parent material: loess

Sampled and described by: G.J. Michaelson 8/1/00

Table 1. Soil morphological properties.

Horizon	Depth cm	Color	Boundary	Redox features	>2mm %	Structure	Consist.	Roots
Oi/Oe	0-8	10YR3/3						
B/A	8-25	10YR4/3						
Bg	25-40+	2.5Y4/2						

Comments: water seeping on top of BC. Vegetation tall shrubs and grasses

Soil Classification: Coarse-loamy, mixed, superactive, pergelic Typic Aquiturbel

127 – Site Name: Kougarok Hinzman Tower Site - Tussock Tundra

Project: LAII-ATLAS Winter C-Flux Proj., C.L. Ping,

Location: - Broad alluvial fan above Kougarok River

Elevation:

Landform: - Broad alluvial fan above Kougarok River

Microrelief: frostboils – Eriophorum tussocks

Slope: 5%

Drainage: somewhat poorly drained

Parent material: alluvial

Sampled and described by: G.J. Michaelson 8/1/00

Table 1. Soil morphological properties.

Horizon	Depth cm	Color	Roots
Oi	0-4	7.5YR2.5/2	Mfc
Oe	4-14	5YR2.5/7.5YR2.5/2 charcoal	Mf
Bg	14+	5Y5/1, 10YR4/6, 10YR5/6 (1:1:1)	Ff

Soil Classification: Fine-silty, mixed, superactive, subgelic, Ruptic-Histic Aquiturbel

Comments: frost at 25 cm, large up to 1 cm ice veins in Bg/Ajj containing bright mottles 2-5 cm diameter.
Charred tussock layer between Oi and Oe.