

Title: Data Dictionary for Soil Taxonomy of Polygons, Barrow, AK

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Section I. Literature Search

Table 1: Soil Horizon Description. [§]Refer to Table 2 for explanation of notations and subscripts

Reference	Study Site	Depth (cm)	Master Horizon [§]	Additional Details
Brown, 1980	Barrow, AK	0 – 2	Oi	Low-Centered Polygon Basin/Center
		2 – 10	Oe/Oi	
		10 – 20	Oe2	
		20 – 40	Oe3	
		> 40	Frozen - Pergelic Cryoaquept or Pergelic Cryohemist	
		0 - 8	Oa/A1	Low-Centered Polygon Rim/Ridge/Edge
		8 - 15	B2g	
		15 - 25	Oa2	
		> 25	Frozen -Pergelic Cryoaquept or Pergelic Cryosaprist	
Bockheim et al., 1999	Barrow, AK	0 – 15	O	Active layer ranges from 30 - 90 cm in thickness; soil parent materials are reworked glaciomarine sediments of Pleistocene age, including the clay- and silt-rich Gubik Formation (Black, 1964)
		15 -	Bg	
				Dominant soils (~ 53 %) of the Barrow region are Typic Aquiturbel
		0 – 25	O	
		25 -	Bg	Second major taxon (22 %) is Typic Histoturbel
				Typic Aquiorthel Comprise 8.6 % of the area

Ping et al., 1998	Prudhoe Bay Arctic Coastal Plain (AK) Arctic Foothills (AK)	0 – 30	Oi	Wet nonacidic Tundra Low- Centered Polygon Center: Typic Historthel
		30 - 50	Oa/Oi	
		50 - 70	Oa/Oi	
		70 - 100	Cgf	
Hinkel et al., 2001	BEO, Barrow, AK	0 – 7	Oe	Active layer thickness ~ 35 cm. A thin (~7 cm) organic layer grades sharply downward into reworked marine silts
		7 – 31	Bg	
		31 - 57	Cg	
White et al., 2004	Various, North Slope & Seward Peninsula, AK	10 – 15	Oe/Oa	Moist Acidic Tundra
		15 - 40	Bg	Classification: Fine-silty, mixed, superactive,
		40 - 60	Oa/Bgjj	pergelic Ruptic– Histic Aquiturbel

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Section II. Text-Book Information

Soil Taxonomy: Order, Suborder, Great Group, Subgroup, Family and Series

US Soil Survey Staff Soil Classification System

Taxa are often defined based on the presence or absence of quantitatively defined diagnostic horizons, which can be at the surface or in the subsurface. Not all horizons are diagnostic

A. Soil Order: Gelisol – Soils with permafrost within 100 cm of the surface

Pedogenic processes in Gelisols are driven primary by the volume changes associated with ice formation and thermal contraction. Three major process suites associated with Gelisol genesis: *cryoturbation, oxidation-reduction and organic matter accumulation. Podzolization, calcification, salinization, weathering and humification occur in Gelisols at reduced rates and intensities.*

Gelisol diagnostic horizon – Gelic materials

Representative horizon sequences: O/A/Bgjj/Cf

Diagnostic horizon: Histic epipedon

Defining Criteria: organic soil material (peat or muck), characterized by saturation and reduction

Minimum thickness: 20 cm

Common field

Equivalence: Oi, Oe, Oa

B. Soil Suborder:

Formative Element	Mnemonic	Meaning
Cry	Crystal	Exists in a cold, cryic soil temperature (< 8 C)
Fibr	Fibrous	Organic soil dominated by raw or virtually raw (fibric) materials
Hem	Hemisphere	Organic soil dominated by partially decomposed (hemic) materials
Hist	Histology	Presence of organic soil materials
Hum	Humus	Abundant organic matter in the B horizon (Bh)

C. Soil Great Group:

A Great Group consists of its suborder name and an additional prefix descriptor that contains formative elements that provide more information about the soil properties

Formative Element	Mnemonic	Meaning
Cry	Crystal	Exists in a cold, cryic soil temperature (< 8° C)
Fibr	Fibrous	Organic soil dominated by raw or virtually raw

Ferr	Ferruginous	(fibric) materials
Hem	Hemisphere	Abundant iron, usually implies “within B horizon”
		Organic soil dominated by partially decomposed (hemic) materials
Hist	Histology	Presence of organic soil materials
Hum	Humus	Abundant organic matter in the B horizon (Bh)

D. Soil Master Horizonation: KEY

Five master soil horizons are recognized and designated using the capital letters O, A, E, B and C. Subordinate horizons may occur within some master horizons and these are designated by suffixes. Soil horizon boundaries are highly contorted, broken and often vertically aligned. O horizon is frequently incorporated into the subsurface, where it can remain for many years.

Often, distinctive layers exist within a given master horizon, and these are indicated by a number following the letter designation. e.g., if two different combinations of structure and colors can be seen in the B horizon, then the soil profile may include a sequence: B1-B2 and so on.

Much of the incorporated histic material eventually comes to reside at the top of the permafrost or in its upper few cms.

Master Horizon	Characteristics	Suffixes for master horizons	Characteristics
O	Layer dominated by organic material (plant litter and humus) in various stages of decomposition	i e a	Slightly decomposed organic material- “fibric” Intermediately decomposed Completely decomposed
A	Mineral horizon that form at the surface or below an O horizon and are characterized by accumulation of humified organic matter intimately mixed with mineral fraction		
B	Subsurface mineral horizons dominated by (i) illuvial accumulation of clay, iron, Al, humus, etc. (ii) removal of primary carbonates(iii) residual concentration of sesquioxides	h jj	Dark, illuvial accumulation of organic matter or humus/or humus. Munsell value and chroma of the horizon must be 3 or less Horizon showing evidence of cryoturbation Strong gleying in which Fe has been reduced and/or removed or in which Fe has been preserved in a reduced state because of saturation with stagnant water.
C	Mineral horizon little affected by pedogenic processes and lack properties of O,A, and B horizons	g f	Munsell chroma of 2 or less Frozen subsoil horizon with Permafrost

Section III. Recommended Soil Classification for BEO (with example data)

Master Horizon	Low Centered Polygon Depth (cm) Profile		
	Center	Trough	Ridge
Oi	0 – 14	0 – 7.5	0 – 19
Bghjj	14 – 45	7.5 – 49.5	19 – 43.5
Cf	45 – 78.5	---	43.5 - 81
Ice Wedge	---	49.5 - 80	---

High Centered Polygon Depth (cm) Profile	
Oi	0 - 9
A/Bh	9 – 17
Bghjj	17 – 28.5
Cf	28.5 - 63

Full Core from Trough of a Low Centered Polygon (with ice wedge)



Ridge of a Low Centered Polygon	
Organic horizon (O)	Mineral permafrost horizon (C) w/ ice

Center (Middle) of a Low Centered Polygon	
Organic horizon (O)	Mineral permafrost horizon (C) w/ ice