Soil Morphology and Classification

Master Horizons

Enough information?

← O horizon

Sub-horizon designations

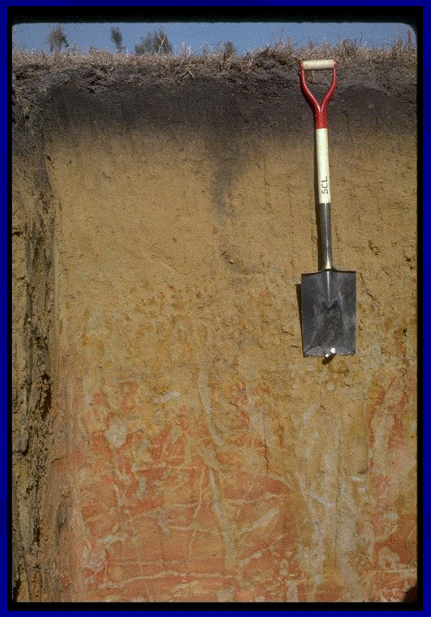
Sub-horizon designations

Subordinate distinctions within master horizons

p – plowing/disturbance
t – clay accumulation
g – gleying
h – illuvial organic matter
w – development of color/structure
o – oxic

Subordinate distinction (p = plowed)

Disturbed surface horizon (cultivation, pasture, forestry)
Used with the A master horizon (e.g. Ap horizon)



Ap horizon

Subordinate distinction (t = clay accumulation)

Translocation of clay or formed in place
Coatings or discrete
Used with the B master horizon (e.g. Bt)
If reduced, can be used with the g sub horizon (Btg)

Subordinate distinction (g = gleying)

•Oxygen de ation.
• Reductio
• low chron
• Often use E and C horizon.

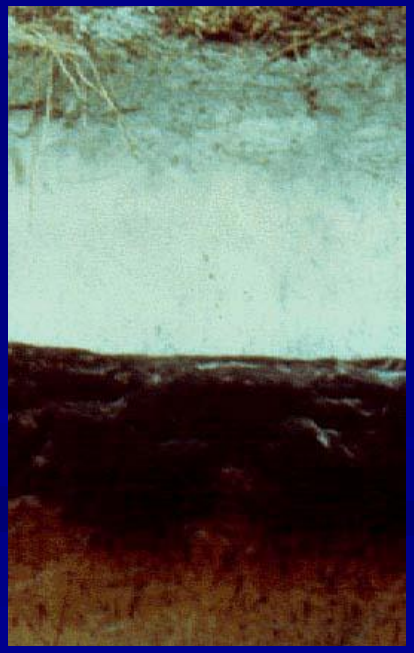
Fe^{3+} oxid
mate

oxidized

Fe^{2+} gley
mat

Subordinate distinction (h = organic accumulation)

- Accumulation of illuvial organic matter-metal complexes
- Coatings on sand and discrete particles
- h = “humic”
- value and chroma approximately 3 or less
- Used with the B master horizon (e.g. Bh horizon)

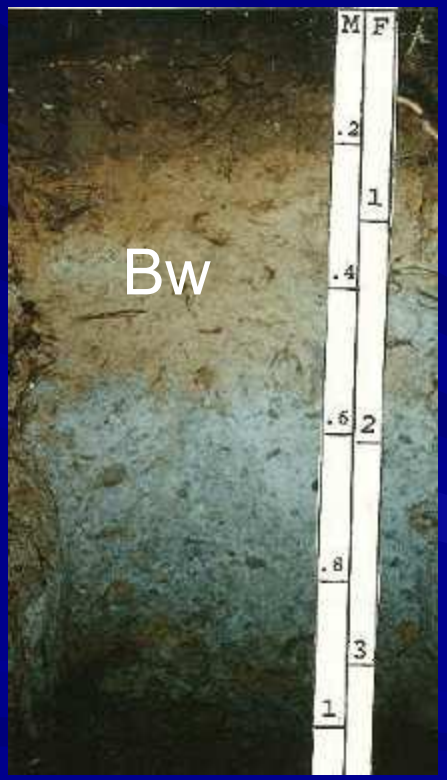


← Bh horizon
“spodic horizon”

Subordinate distinction (w = color or stucture)

Non-illuvial development of color or structure
"w" can = "weak"

Commonly used with the B master horizon (e.g. Bw)



Subordinate distinction (o = oxic horizon)

Low activity clays
Few weatherable materials
Little rock structure
Fe and Al oxides

Subordinate distinctions

g – gleying
h – illuvial organic matter
p – plowing/disturbance
t – clay accumulation
w – development of color/structure
o – oxic

Subordinate distinctions and Organic Matter

Subordinate distinction (a, e, i)

Denotes the degree of organic matter decomposition in the O horizon.

Oa – highly decomposed (sapric)
Oe – moderately decomposed (hemic)
Oi – slightly decomposed (fibric)

Sapric –most decomposed, low plant fiber, low water content
Hemic – intermediate decompostion
Fibric – least decomposed, recognizable fibers

Summary

Master: O, A, E, B, C, R

Sub horizon symbols: g, h, p, t, w and a,e,i

Examples: Oa, Oe, Oi
Bt
Bg
Btg
Bw
Ap

Other Designations

Vertical Subdivisions

Characterized by similar master and/or subordinate properties separated by “degree”.

Bt horizons

Bt1

Bt2

Bt3

Transitional Horizons

Transitional layers between master horizons.

AE
EB
BE

Dominant character

Subordinate Character

Synthesis

Ap

AE

E

Bh

Btg1

Btg2

Soil Taxonomy

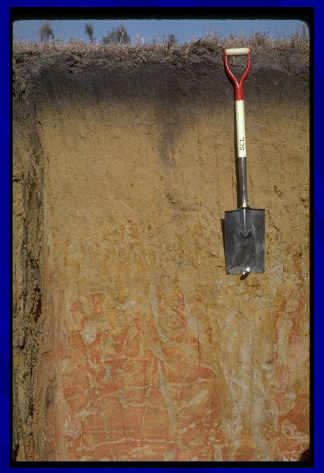
Soil Classification/Taxonomy

Hierarchical

Based on soil profile characteristics and the concept of soils as a natural body.

Observable properties: color, texture, structure, pH, O.M…

Soil Profile



Genesis

1883 V.V. Dukachaev: climate, vegetation, soil

1927 C.F. Marbut (USDA) applied to U.S. (1965)

Soil Classification/Taxonomy

USDA classification system

Soil Survey Staff 1965

Soil Taxonomy published 1975

- Adamsville: Hyperthermic, uncoated Aquic Quartzipsamment

Soil Taxonomy Hierarchy

Order

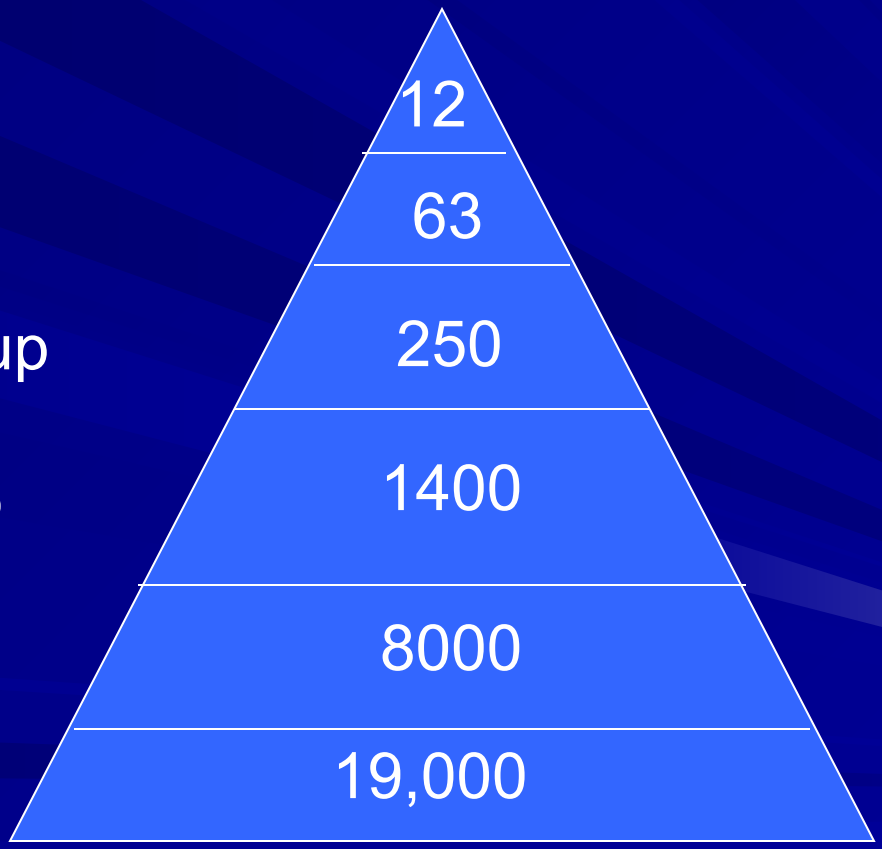
Suborder

Great group

Sub group

Family

Series



Kingdom
Phylum
Class
Order
Family
Genus
Species

Units for Soil Classification

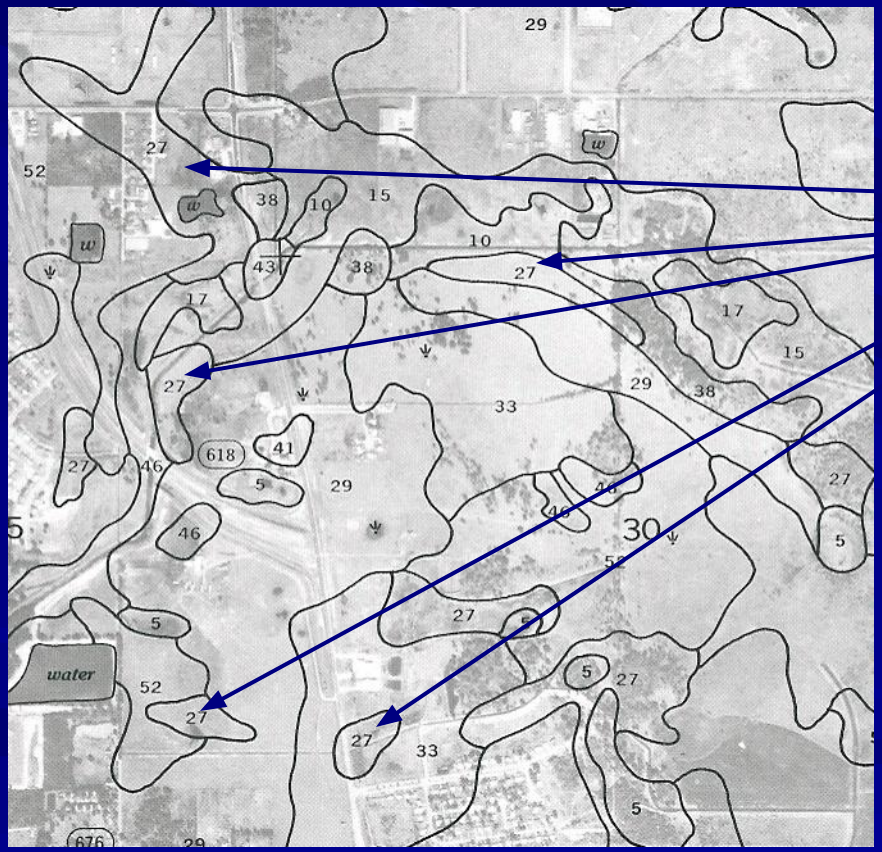
Pedon – smallest three-dimensional unit that displays the full range of properties characteristic of a given soil. (1-10 m^2 of area)

- the fundamental unit of soil classification

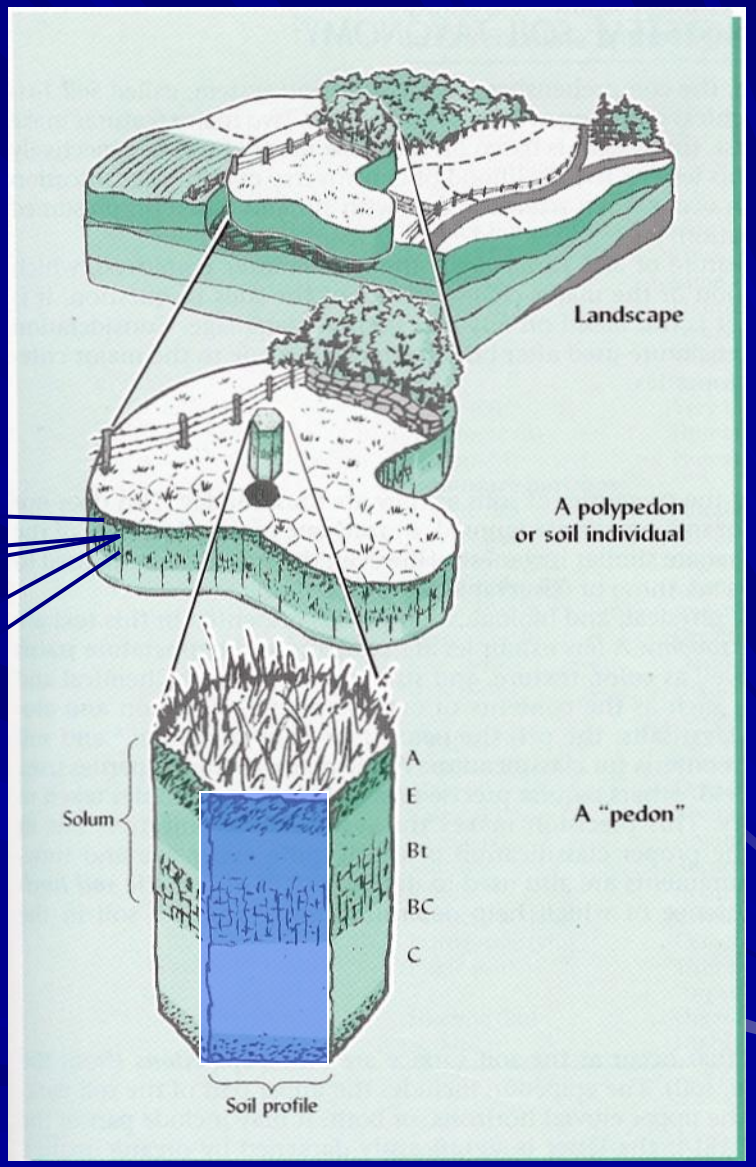
Polypedon – group of closely associated pedons in the field

Soil Series – class of soils world-wide which share a common suite of soil profile properties

Soil Sampling Units



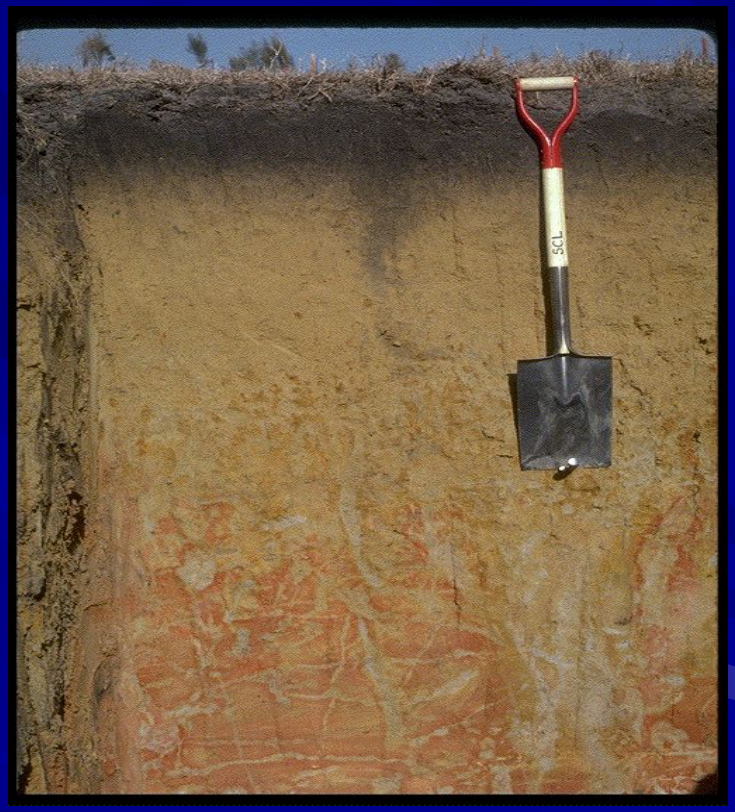
Malabar Series



Diagnostic Horizons

Surface

Subsurface

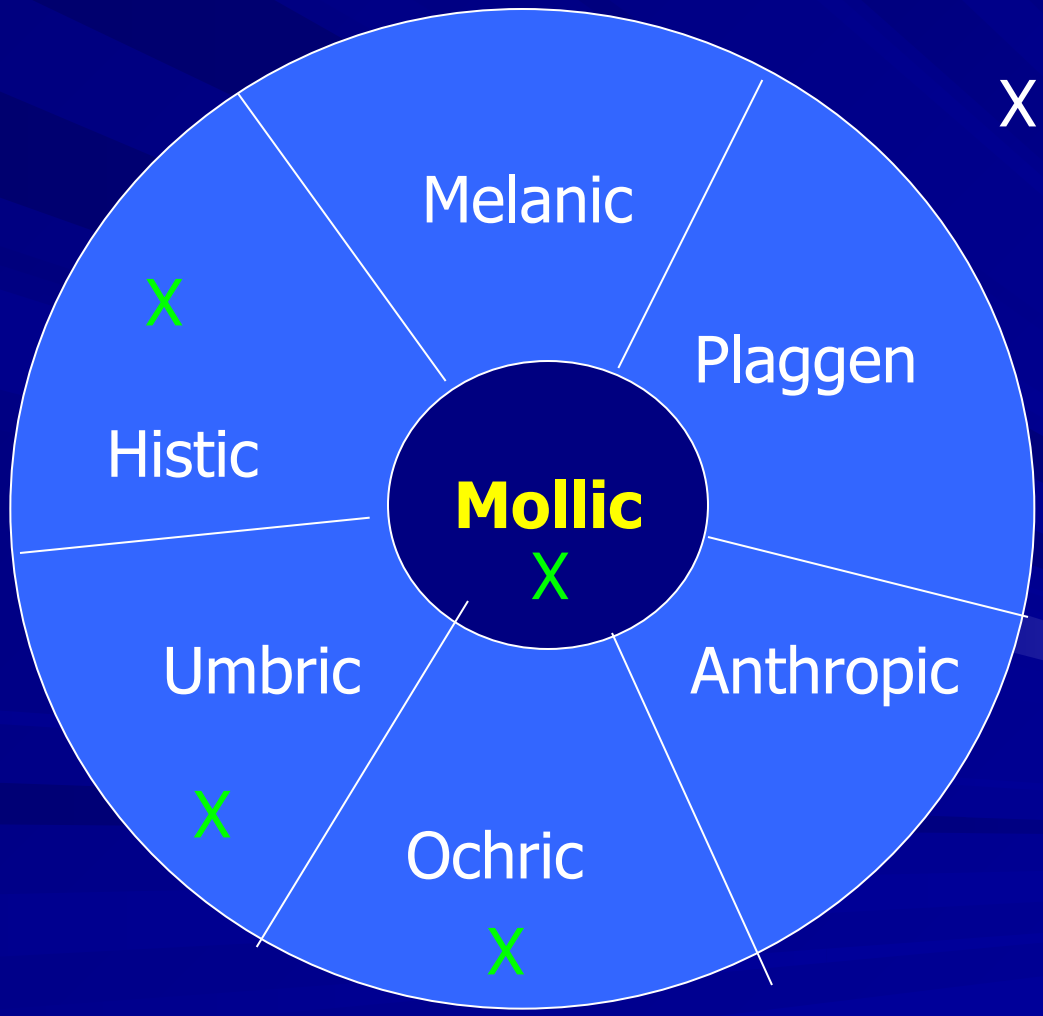


Diagnostic Surface Horizons

Epipedons

- Mollic
- Umbric
- Ochric
- Histic
- Melanic
- Plaggen
- Anthropic

Diagnostic Surface Horizons



X = Florida

Mollic Epipedon

Thickness > 18-25 cm

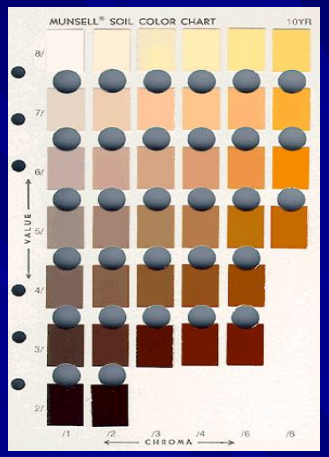
Color value < 3.5 moist

chroma < 3.5 moist

Organic Carbon > 0.6 %

Base Saturation > 50 %

Structure strongly developed



Organic carbon = organic matter x 0.5

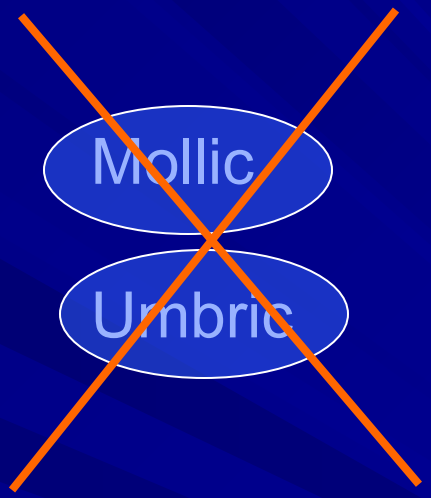
Umbric Epipedon

Meets all criteria of the Mollic epipedon, except base saturation < 50%

Chemically different than Mollic

Ochric Epipedon

Too: thin
light
low in O.M



Ochric = pale

Extremely common

Histic Epipedon

Organic horizon
Formed in wet areas
Black to dark brown
Low bulk density
20-30 cm thick

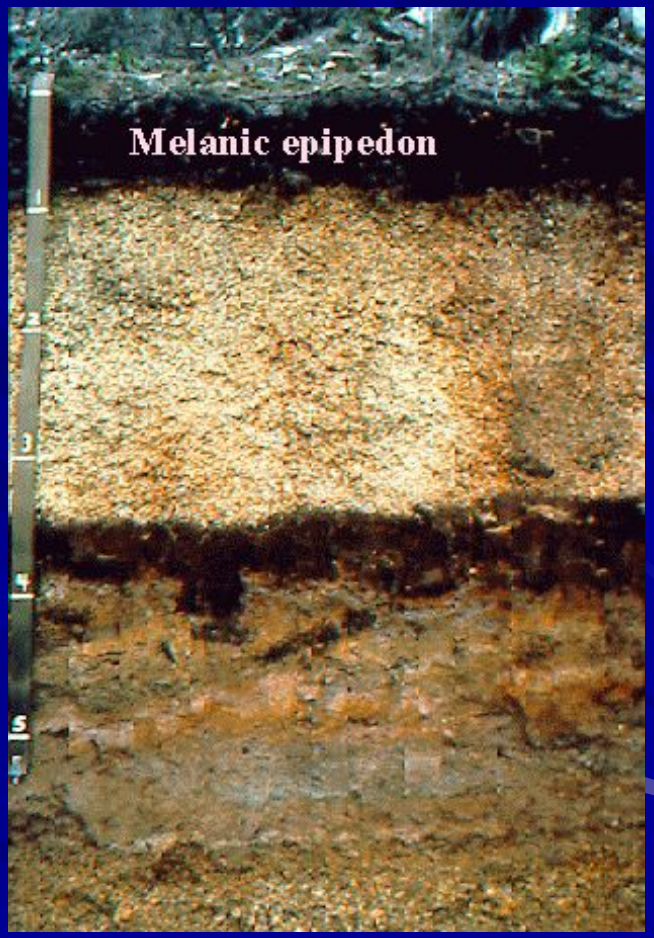
Organic = > 20% - 35% O.M.
(water saturation, clay content)

Melanic Epipedon

Similar in properties to Mollic

Formed in volcanic ash

Lightweight, Fluffy



Anthropic Horizon

- Resembles mollic (color, o.m.)
- Use by humans
- Shells and bones
- Water from humans

Plaggen Epipedon

Produced by long-term (100s yrs.) manuring

Old, human-made surface horizon

Absent in U.S.

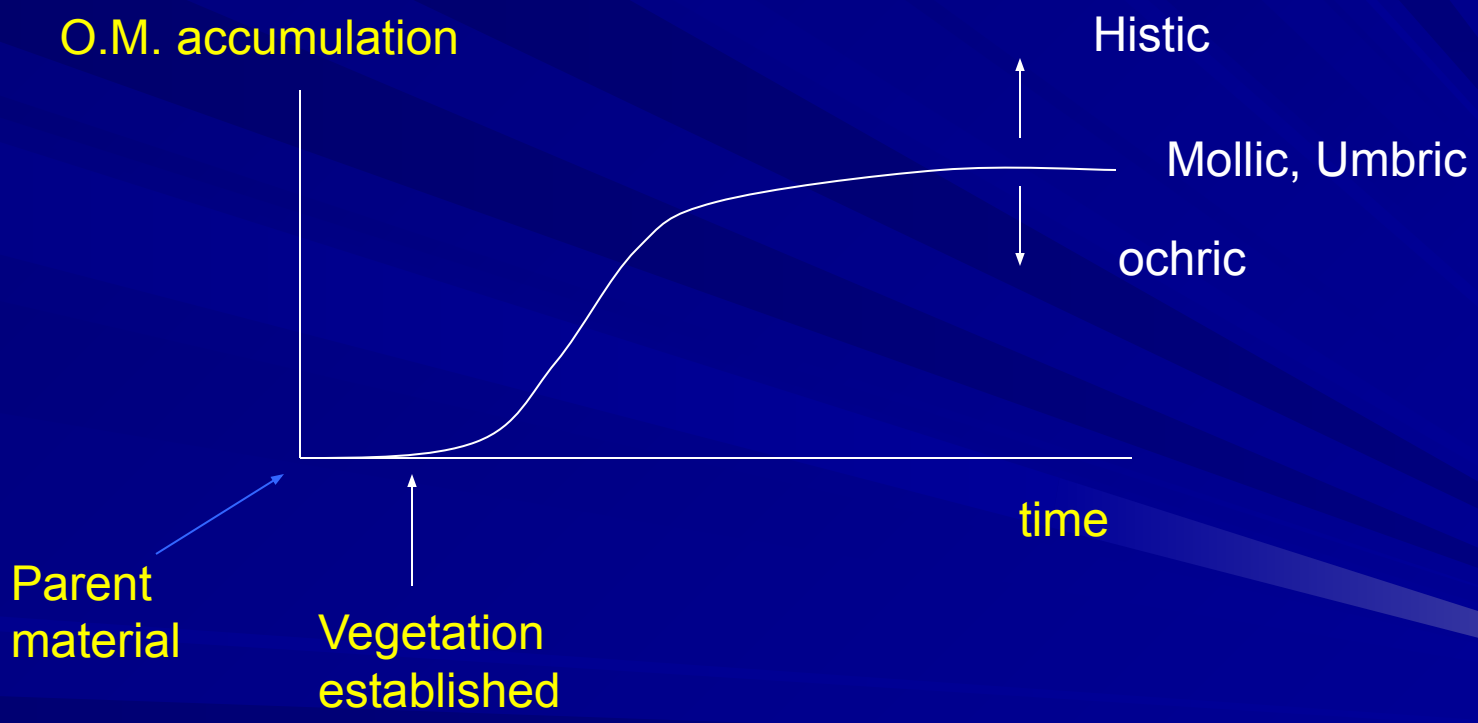
> 50 cm thick

Diagnostic Surface Horizons

Epipedons

Mollic Umbric Ochric	Very common
Histic Melanic	“specialized”
Plaggen Anthropic	Human-derived

Organic Matter Accumulation



t_{max} = 3000 yrs

Diagnostic Sub-surface Horizons

Diagnostic Subsurface Horizons

Formation
Translocation
Transformation

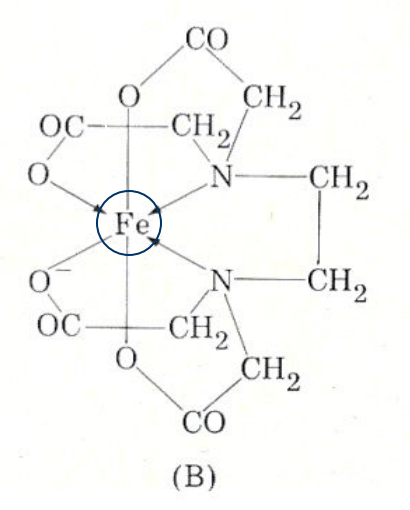
Clays Organic Matter Oxides

Subsurface Horizons

Formation
Translocation
Transformation

Organic Matter

Dark colors
Metals (Fe, Al)



(B)

Clays

smectites

Kaolinite

Oxides

Iron
Aluminum

Also: salts, carbonates, sulfides

Diagnostic Subsurface Horizons

Albic
Argillic
Spodic
Oxic
Cambic
Kandic
Sombric
sulfuric

Natric
Agric
Calcic
Gypsic
Salic
Duripan
Fragipan
Placic

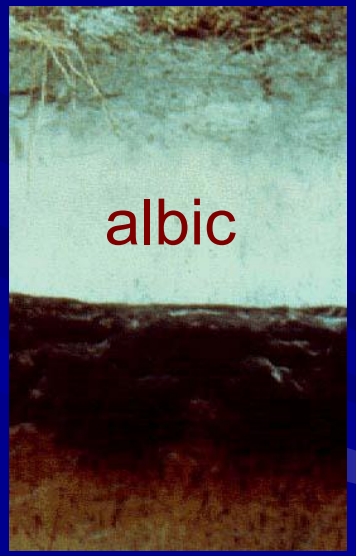
Sub-Horizon Designations

Diagnostic Subsurface Horizons

Albic (white) Horizon

- Light-colored (Value > 6 moist)
- Elluvial (E master horizon*)
- Low in clay, Fe and Al oxides
- Generally sandy textured
- Low chemical reactivity (low CEC)
- Typically overlies Bh or Bt horizons

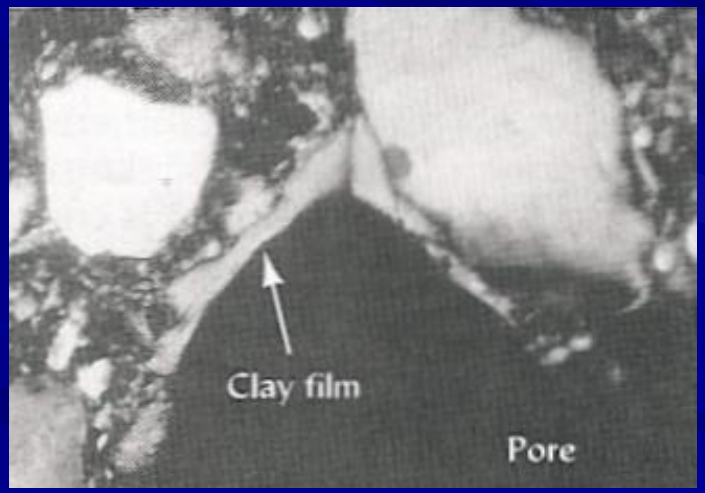
*not all E horizons are albic horizons



Diagnostic Subsurface Horizons

Argillic Horizon

Illuvial accumulation of silicate clays
Illuvial based on overlying horizon
Clay bridges
Clay coatings



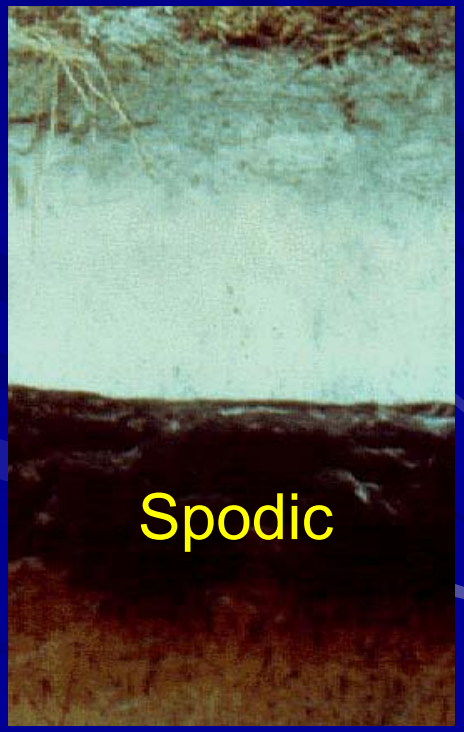
Diagnostic Subsurface Horizons

Argillic Horizon		Kandic Horizon
High	Activity of Clays	Low
Necessary	Illuviation of clay	Not Necessary

Diagnostic Subsurface Horizons

Spodic Horizon

- Illuvial accumulation of organic matter and aluminum (+/- iron)
- Dark colored (value, chroma < 3)
- Low base saturation (acidic)
- Formed under humid acid conditions

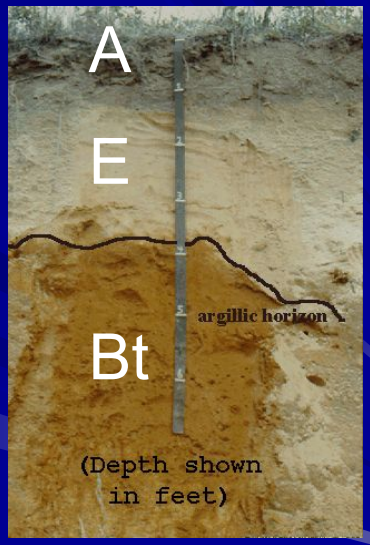


Elluviation and Illuviation

Elluviation (E horizon)

Organic matter → Bh horizon → Spodic horizon

Clays → Bt horizon → Argillic horizon



Diagnostic Subsurface Horizons

Oxic horizon

- Highly weathered (high temperatures, high rainfall)
  - High in Fe, Al oxides
  - High in low-activity clays (kaolinite < smectite < vermiculite)

activity

Diagnostic Horizons

Epipedons

- Mollic
- Umbric
- Ochric
- Histic
- Melanic
- Plaggen
- Anthropic

Subsurface

- Albic
- Kandic
- Argillic
- Spodic
- Oxic

Soil Taxonomy

Diagnostic Epipedons
Diagnostic Subsurface horizons
Moisture Regimes
Temperature Regimes