

Soil Morphology and Composition

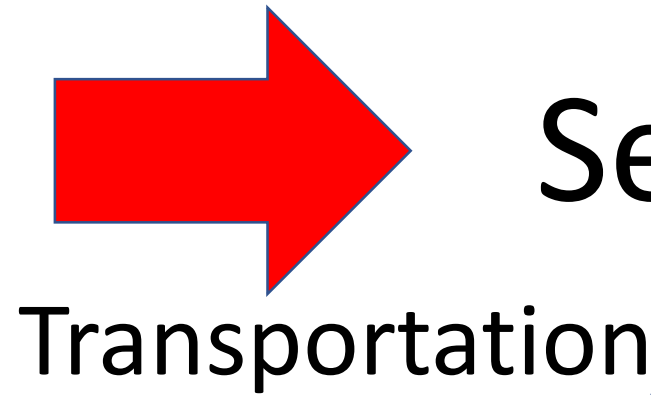
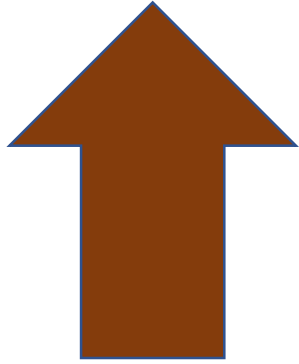
Soils and Landscapes

Dr. C.E. Heinzl

Soil – defined ?

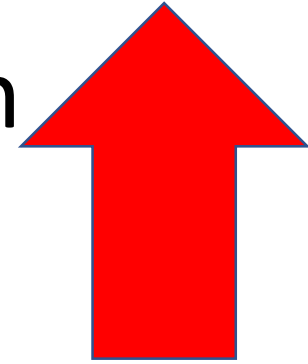
- Depends
- A soil is a natural body consisting of layers (horizons) of mineral and/or organic constituents of variable thickness, which differ from the parent materials in their morphological, physical, chemical, and mineralogical properties and their biological characteristics.

Soil



Sediment

Transportation

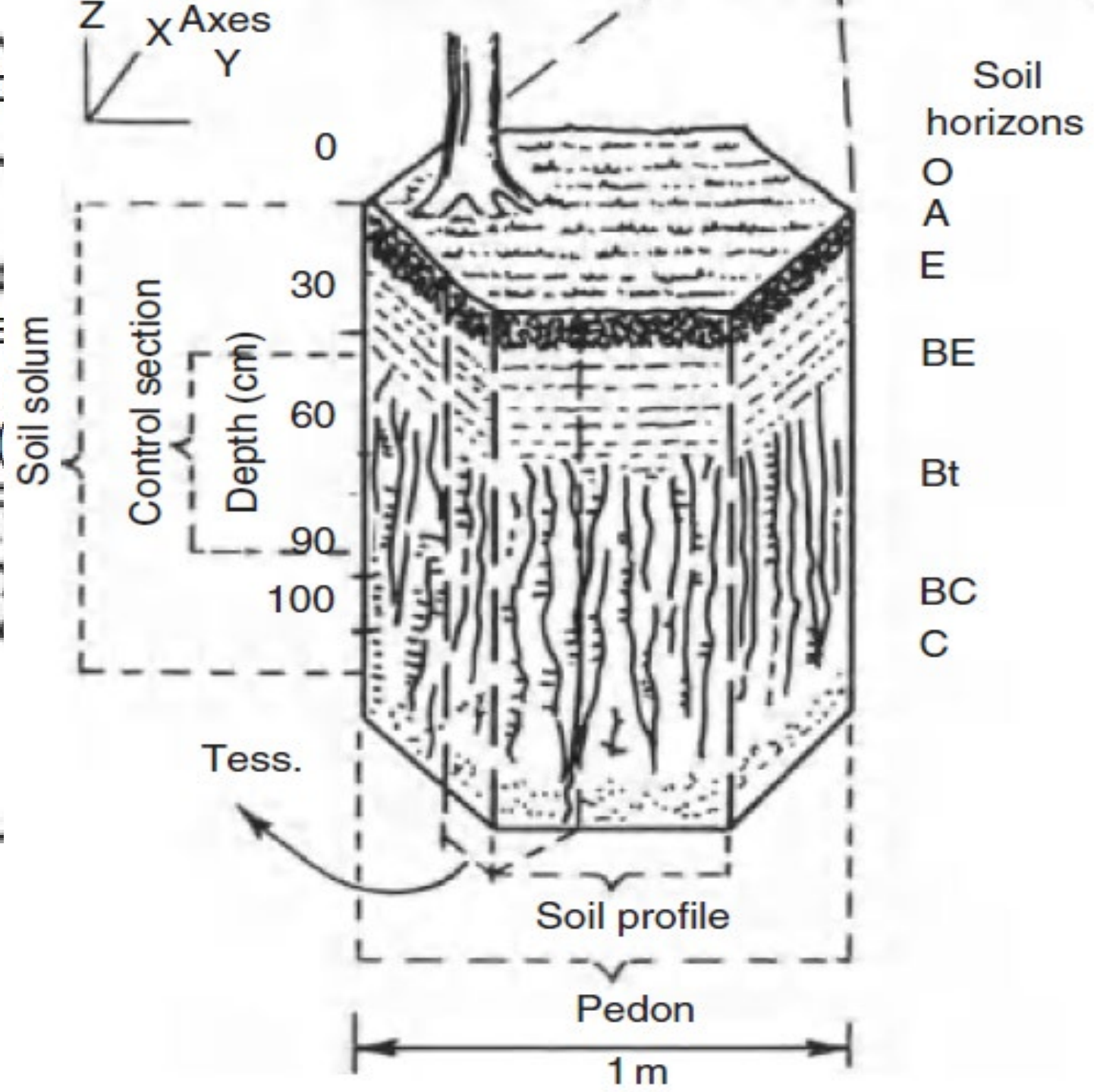
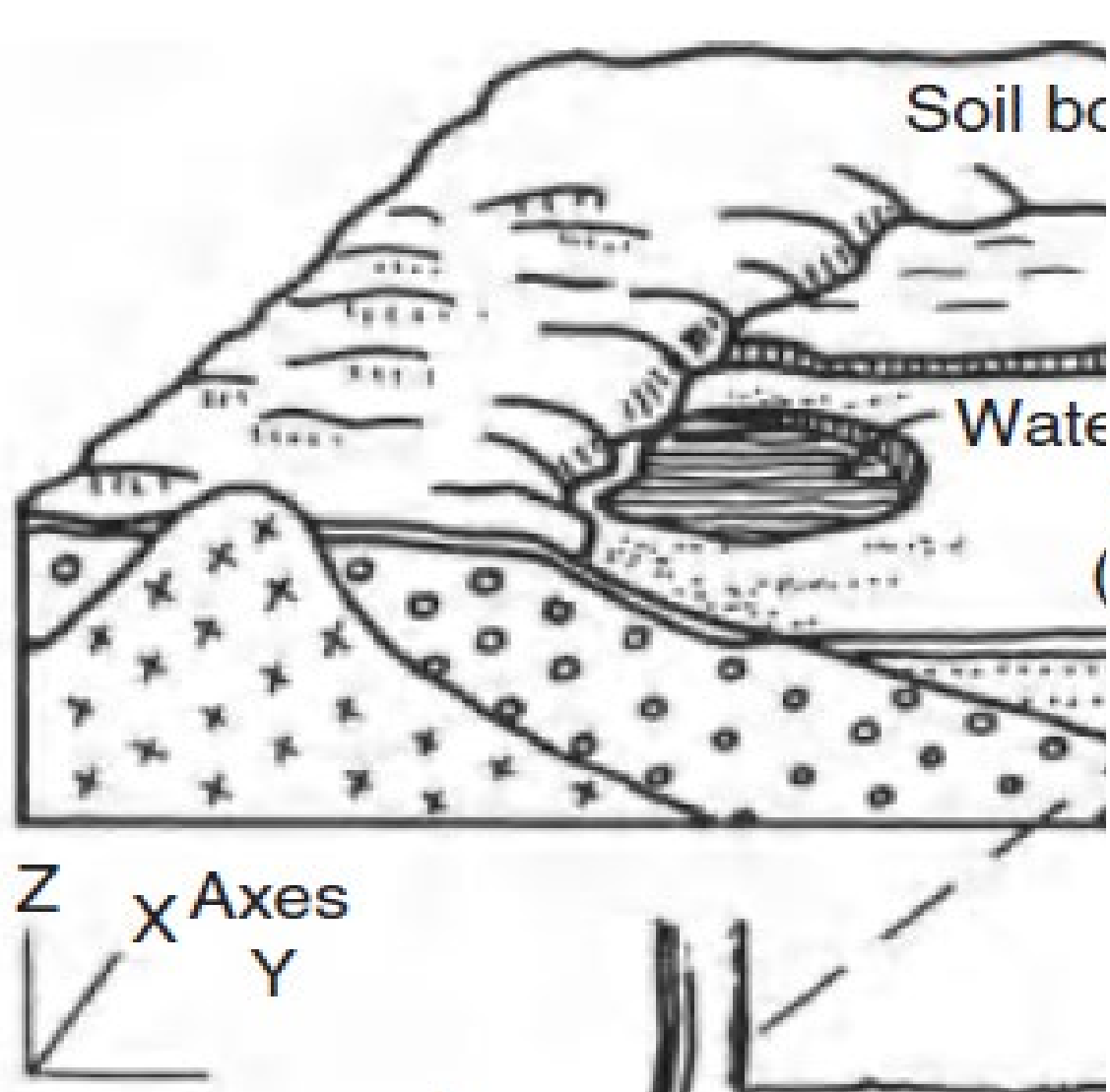


Weathering Versus Erosion

*Soil is not a geologic deposit,
it is a product of in situ weathering.*

Soil morphology

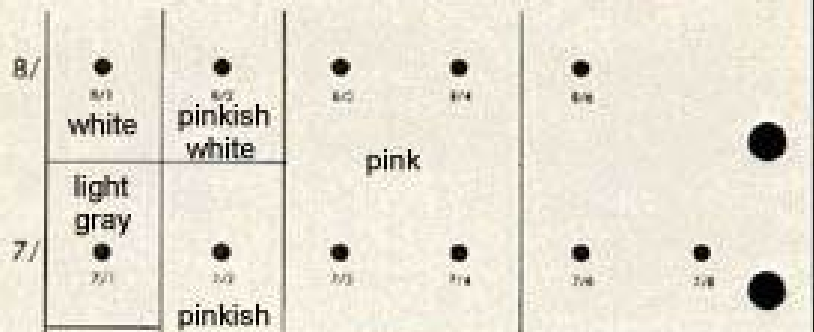
- Soil morphology =
best observed, described, and studied in the field.
- Soil morphology =
form, structure, & organization of the soil material.



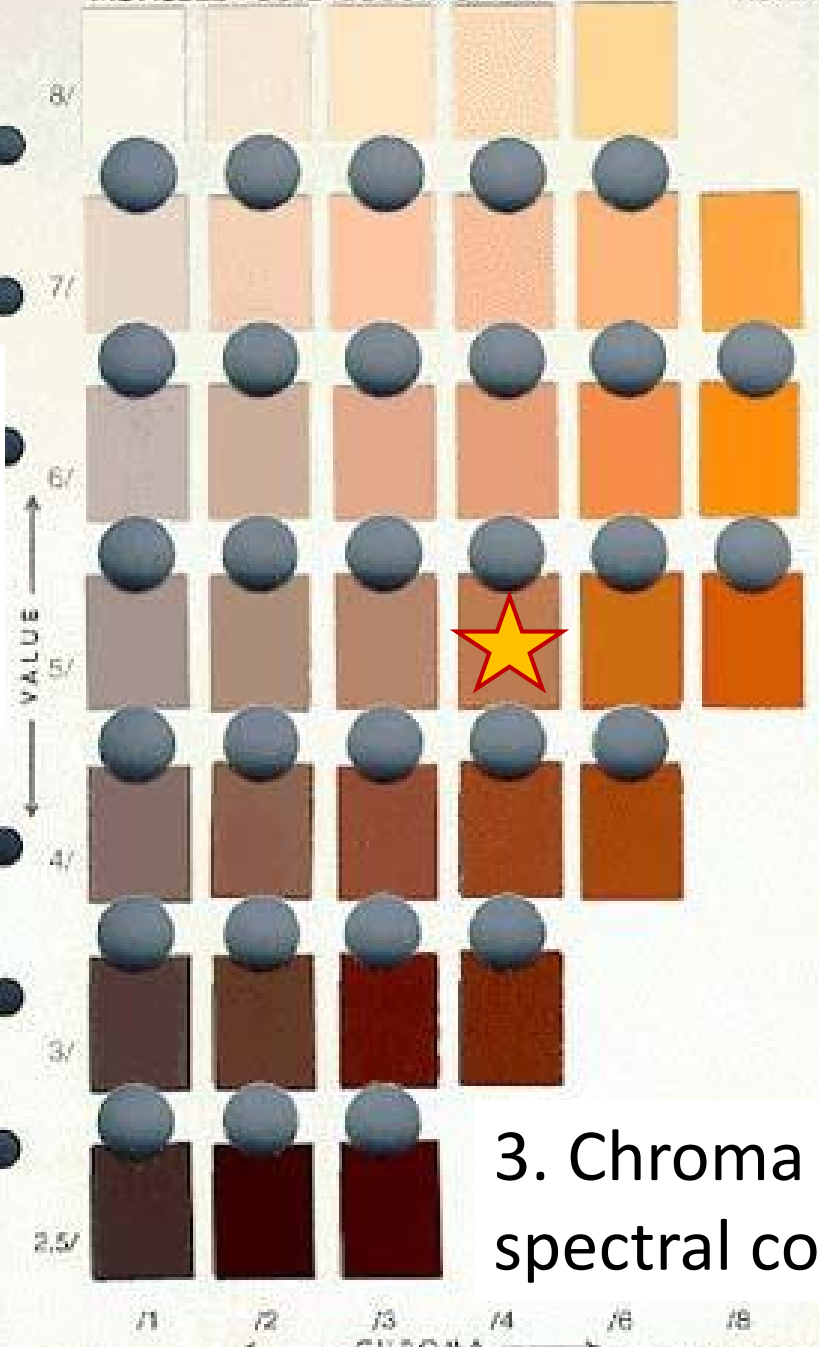
Describing Morphology

- Color
- Thickness
- Structure
- Texture

HUE 7.5YR MUNSSELL® SOIL COLOR NAME DIAGRAM



MUNSSELL® SOIL COLOR CHART 7.5YR



1. Hue - dominant spectral color and is related to wavelengths of light

Y = yellow

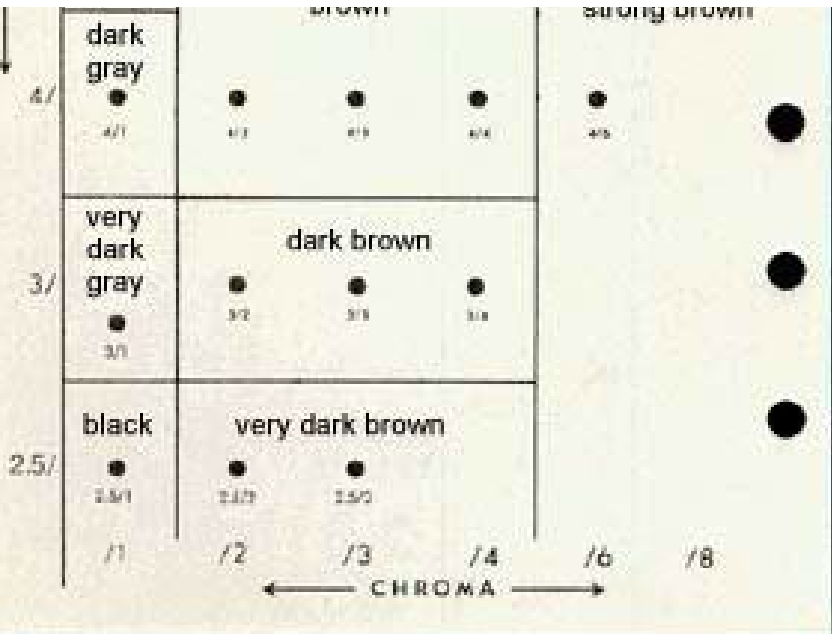
R = Red

G = Gley

Munsell Soil Color Chart

e.g. 7.5YR 5/4

2. Value - darkness or lightness of the color / related to the amount of light reflected.



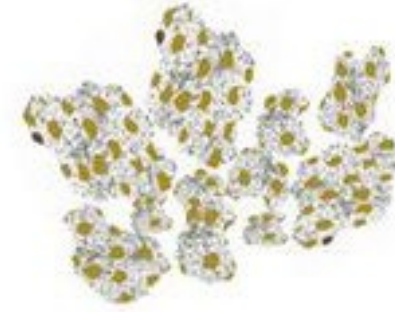
3. Chroma - purity or strength of spectral color

Structure

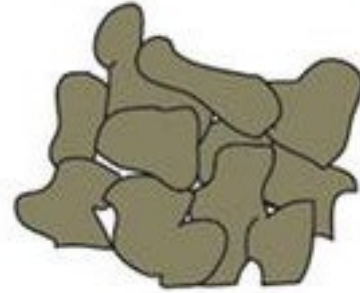
- soil peds form shapes or structures



Granular (high permeability)



Aggregated (high permeability)



Blocky (moderate permeability)



Columnar/prismatic (moderate permeability)

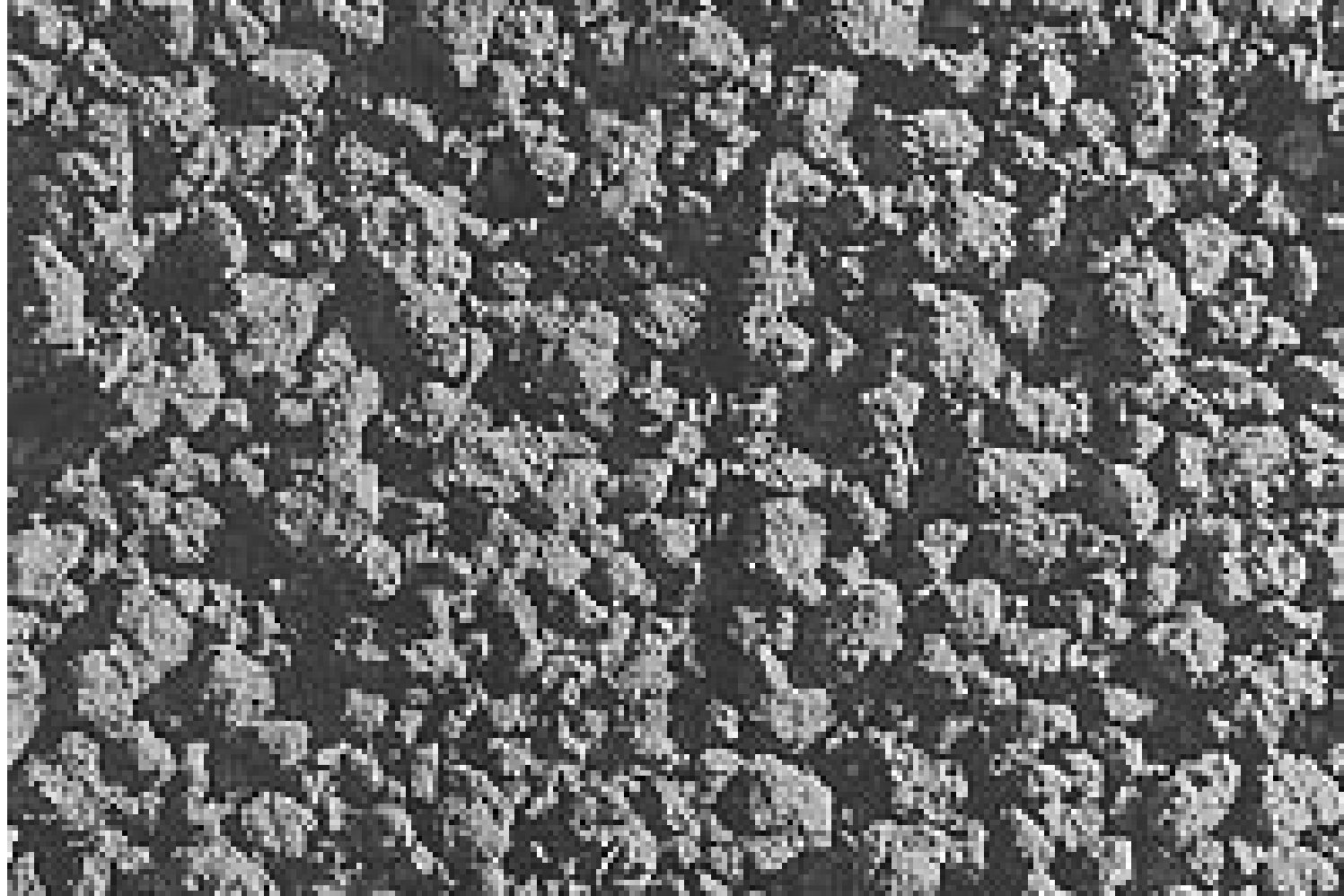
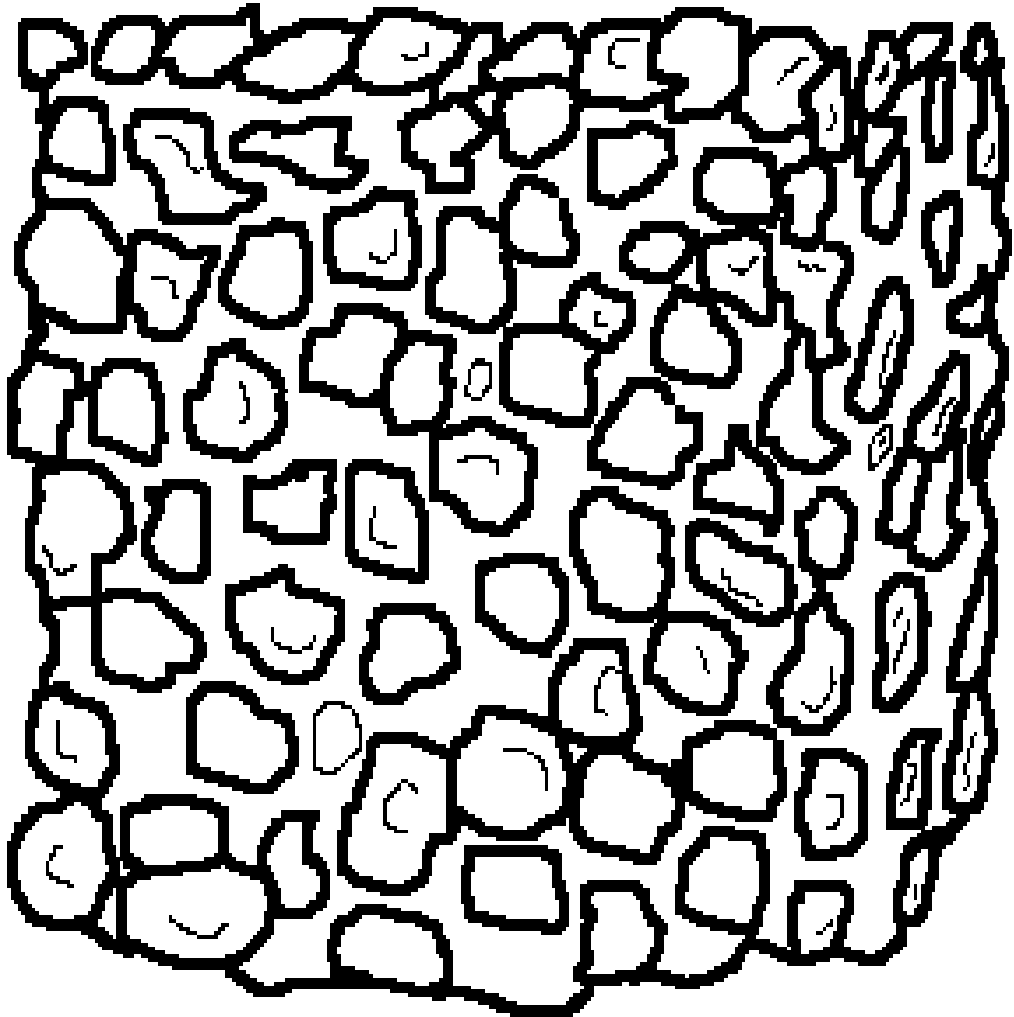


Platey (low permeability)



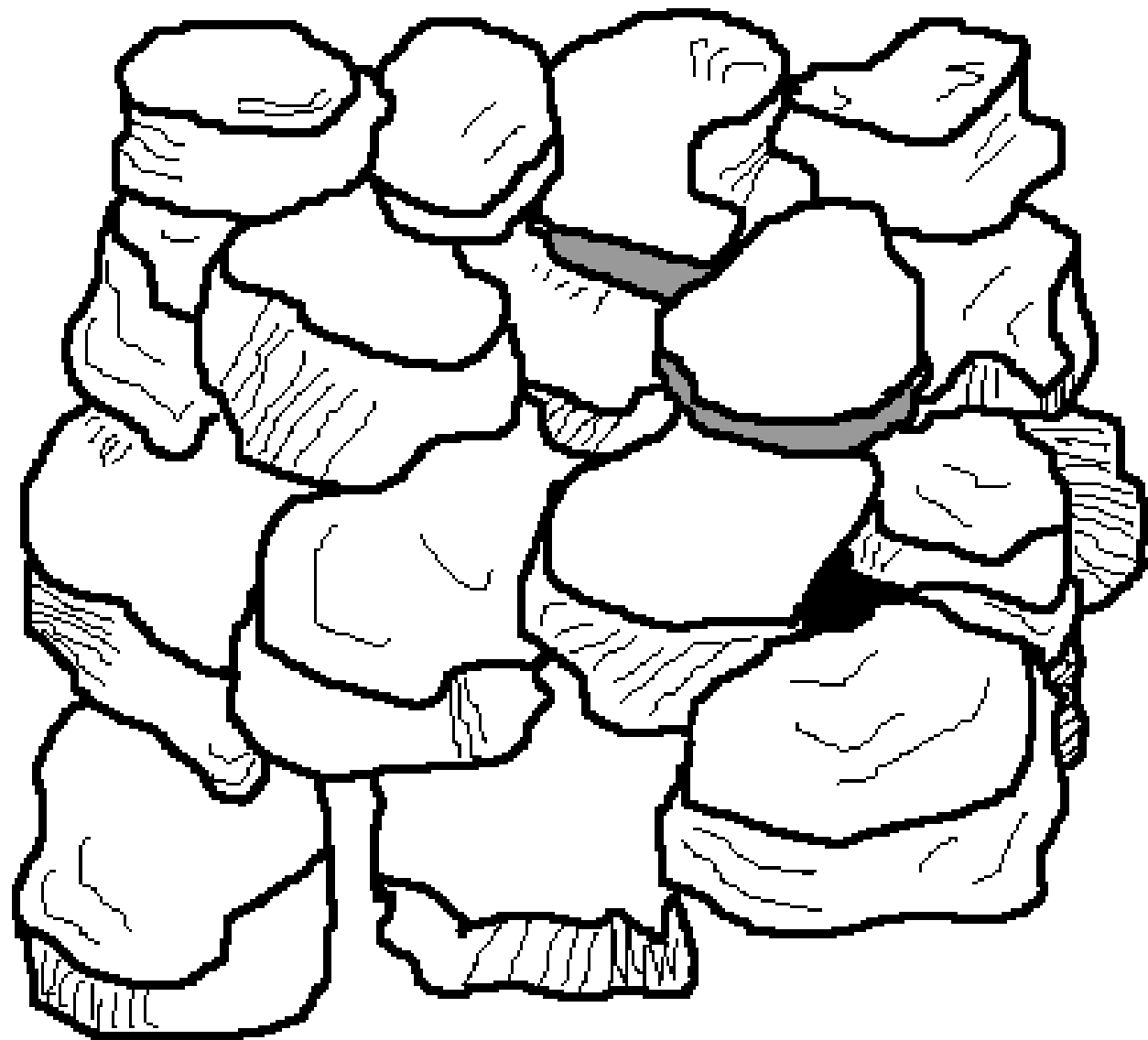
Massive (low permeability)

Granular



A-horizon

Blocky

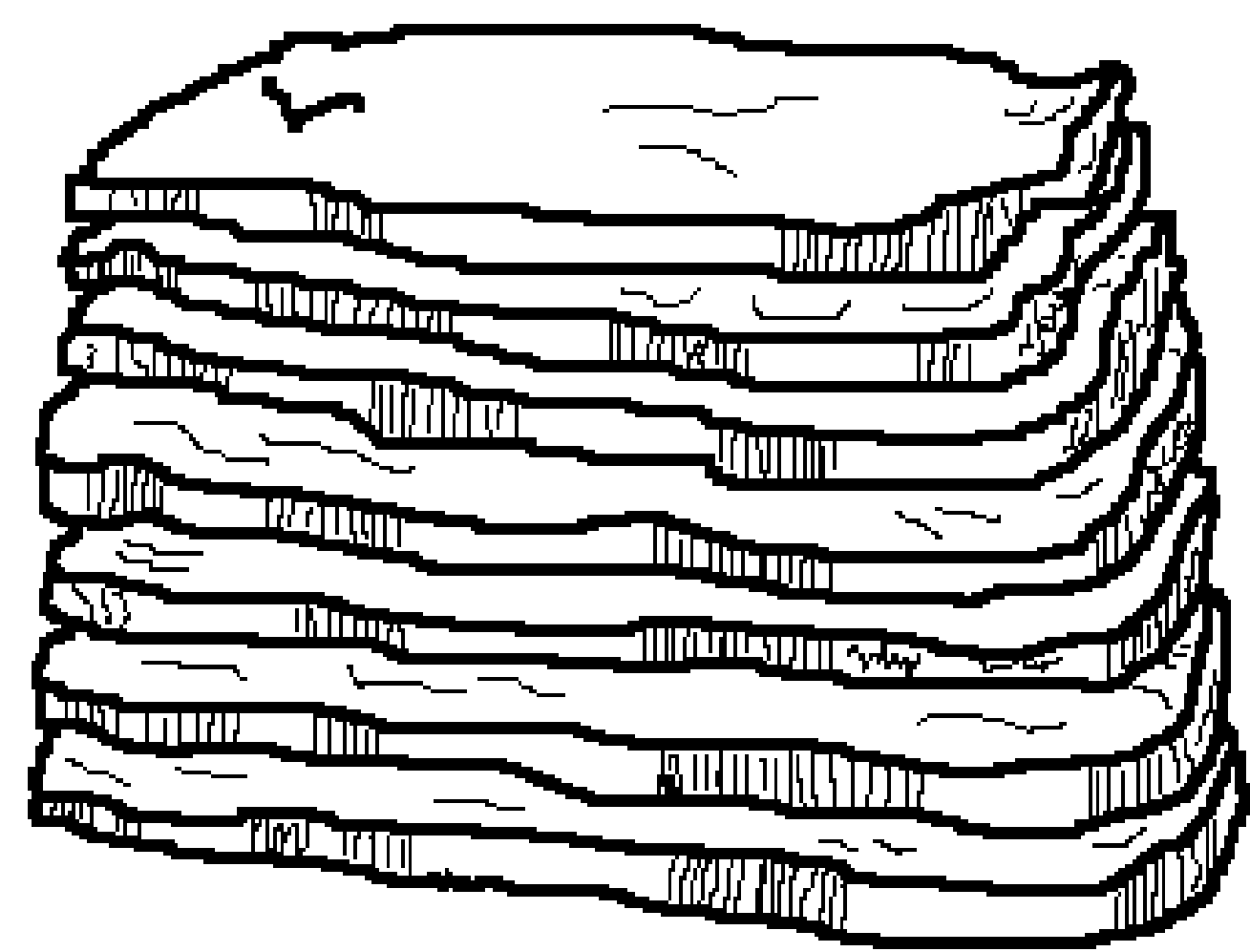


B-horizon

Angular to Sub-angular

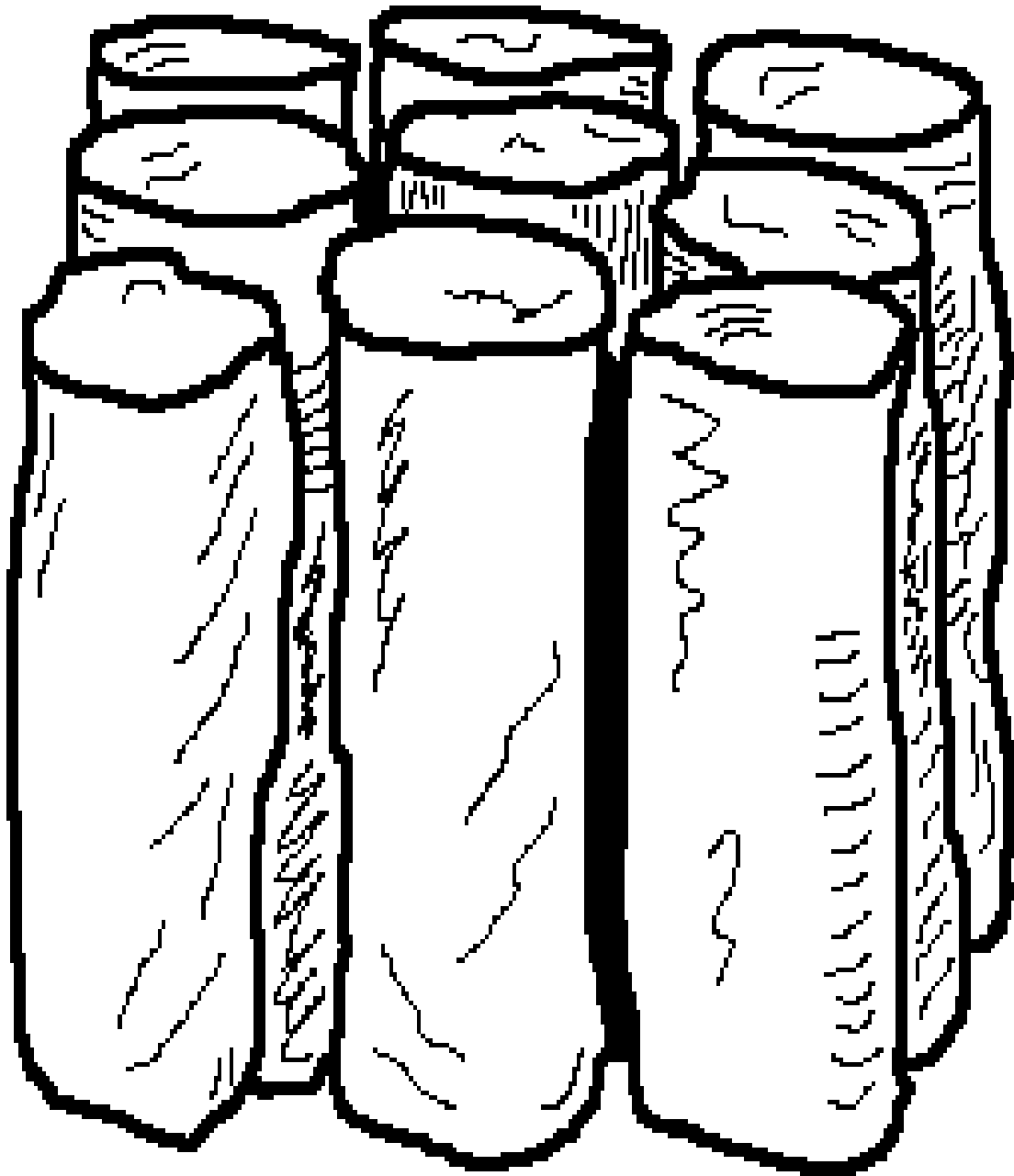
Platy

A to E horizons



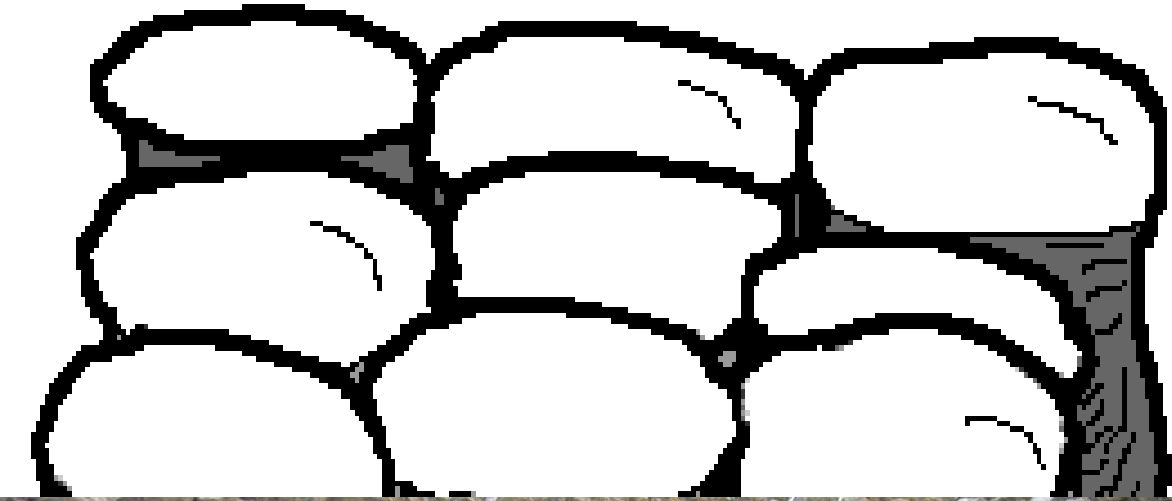
Prismatic

B - Horizons



Columnar

B - Horizons



Structural grade

- Strong = Peds distinct and obvious in place, separate cleanly and persist in a hand sample
- Moderate = peds are well-formed and evident in place, most of sample retains shape when observed in a hand sample
- Weak = peds are barely observable
- None

GRAVEL

Relative soil particle sizes

Soil Texture

Coarse fragment
(cf)

- Ped size: Sand, Silt, Clay

SAND

SILT

CLAY

invisible at
this scale

mm

0

1

2

3

4

5

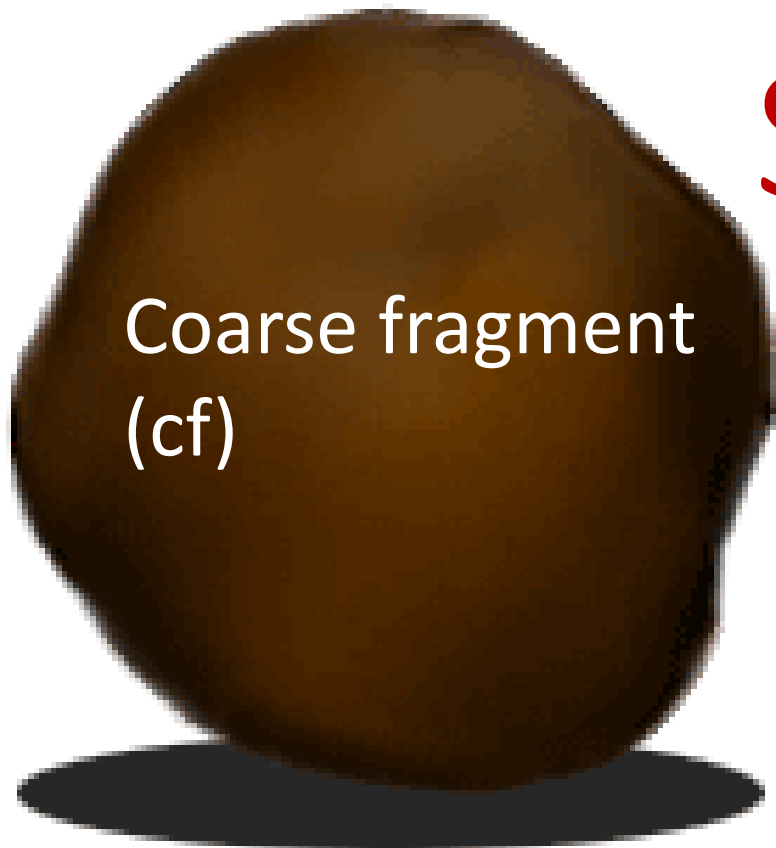
inches

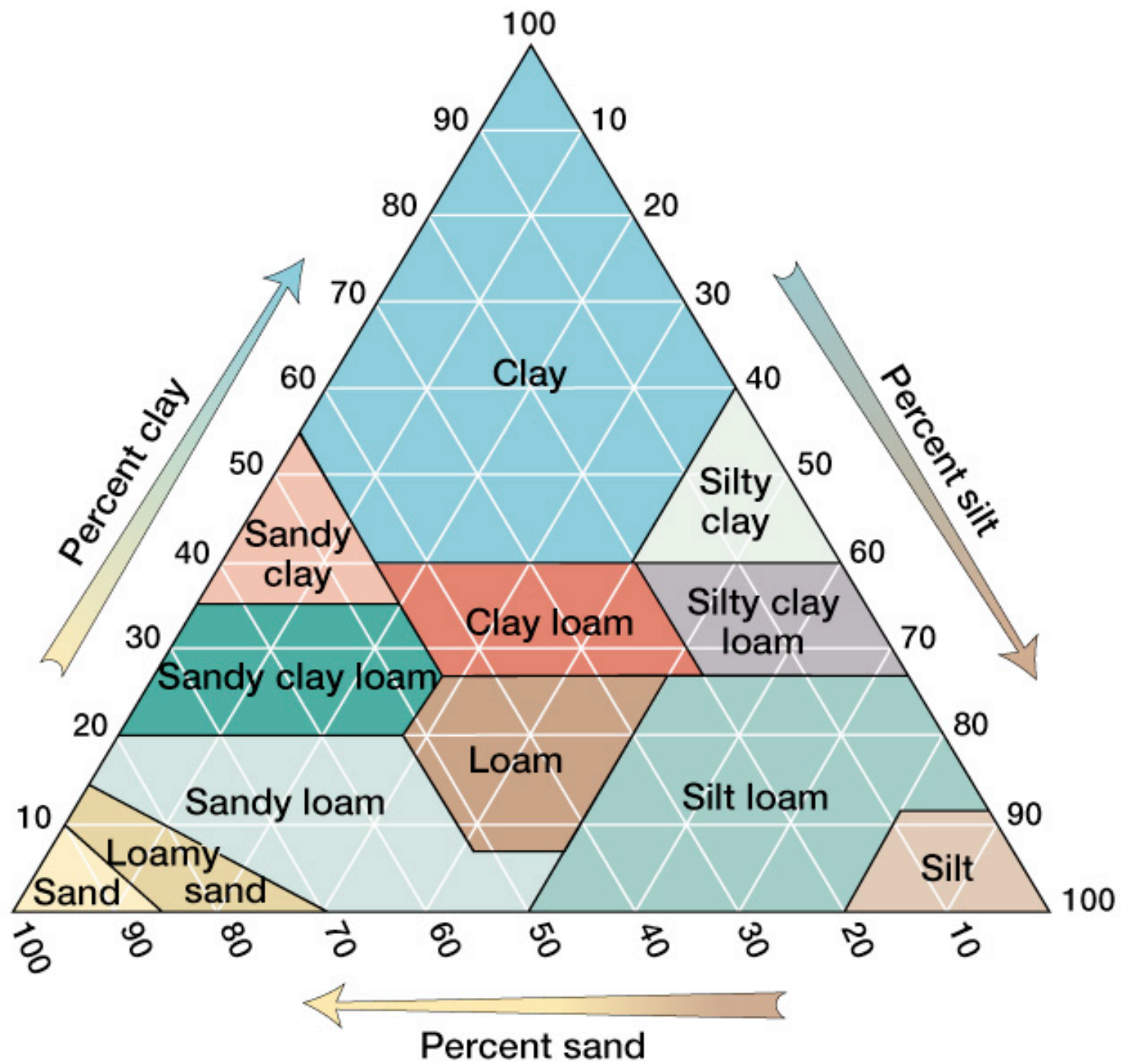
0

$\frac{1}{16}$

$\frac{2}{16}$

$\frac{3}{16}$







Consistence – Engineering properties

- An evaluation soil of cohesive and adhesive properties/ its response to applied pressure
 - Rupture resistance = soil strength
 - Stickiness = tendency of wet soil material to adhere to other objects
 - Plasticity = soil materials ability to deform without breaking
- Soil water content is critical to the assessment of these properties.

Class			
Dry	Moist	Cementation	Specimen Fails Under
Loose	Loose	Not applicable	Intact specimen not obtained
Soft	Very friable	Noncemented	Very slight thumb and forefinger pressure
Slightly hard	Friable	Extremely weakly cemented	Slight thumb and forefinger pressure
Moderately hard	Firm	Very weakly cemented	Moderate thumb and forefinger pressure
Hard	Very firm	Weakly cemented	Strong thumb and forefinger pressure
Very hard	Extremely firm	Moderately cemented	Two hands required to rupture block
Extremely hard	Slightly rigid	Strongly cemented	Underfoot with full body weight
Rigid	Rigid	Very strongly cemented	Ruptures when struck with 1 kg hammer
Very rigid	Very rigid	Indurated	Can not be ruptured with hammer

Stickiness

Stickiness Class

Test Description

Nonsticky

Almost no material adheres to thumb or forefinger

Slightly sticky

Some soil adheres to both fingers; soil stretches little

Moderately sticky

Soil adheres to both fingers; soil stretches some

Very sticky

Soil adheres firmly to both fingers; soil stretches greatly

Plasticity

Plasticity Class

Test Description

Nonplastic

A roll 6-mm thick cannot be formed

Slightly plastic

A roll 6-mm thick supports its own weight

Moderately plastic

A roll 4-mm thick supports its own weight

Very plastic

A roll 2-mm thick supports its own weight

Roots and Pores

Size Class of Roots or Pores	Root or Pore Diameter
------------------------------	-----------------------

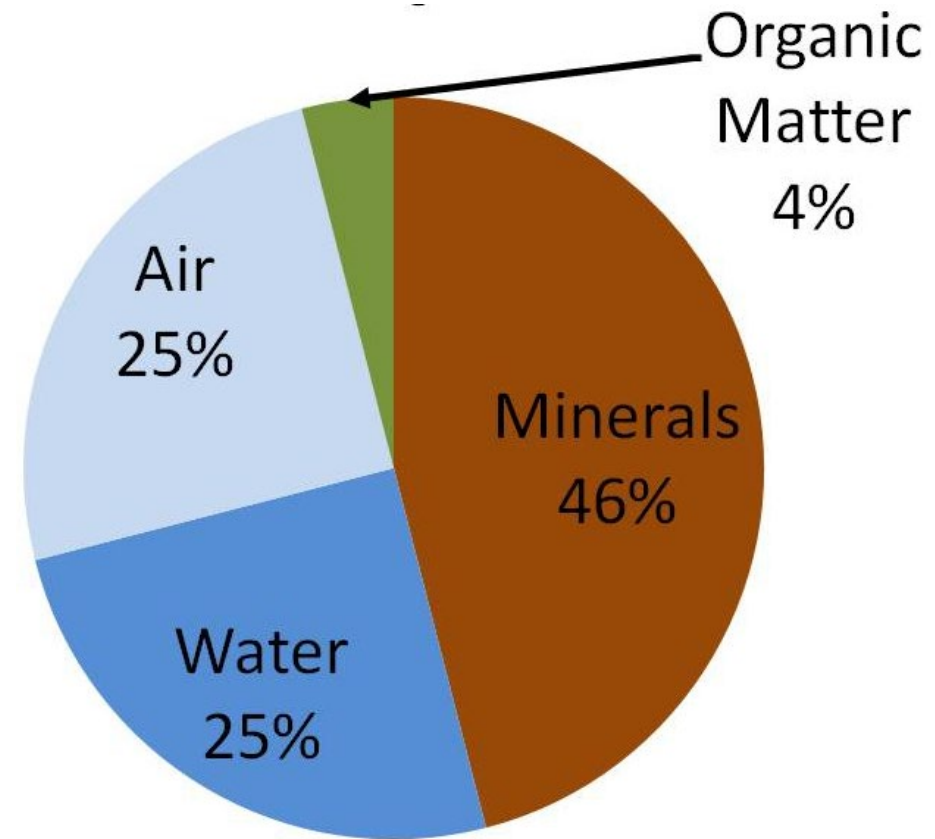
Very fine	<1 mm
Fine	1–2 mm
Medium	2–5 mm
Coarse	5–10 mm
Very Coarse	10 mm or larger

Root or Pore Quantity Classes	Number of Roots or Pores Observed
-------------------------------	-----------------------------------

Few	<1 per unit area
Common	1–5 per unit area
Many	5 or more per unit area

Soil composition

- Soil composition includes chemical/mineralogical measurements of soil material removed from defined positions (horizons or layers) within pedons
- Laboratory soil science
- Plays an important part in classification and taxonomy



Chemistry's importance increases over time

- Changing technologies
 - Weight percentages of each element may be reported oxide form (E.g. Fe_2O_3 , Al_2O_3).
 - These weight percentages may then be divided by the molecular weight of each compound to give molecular percentages
- *Soil Survey Laboratory Methods Manual* (USDA-NRCS, 2004)

WHY IS CHEMISTRY IMPORTANT?

