

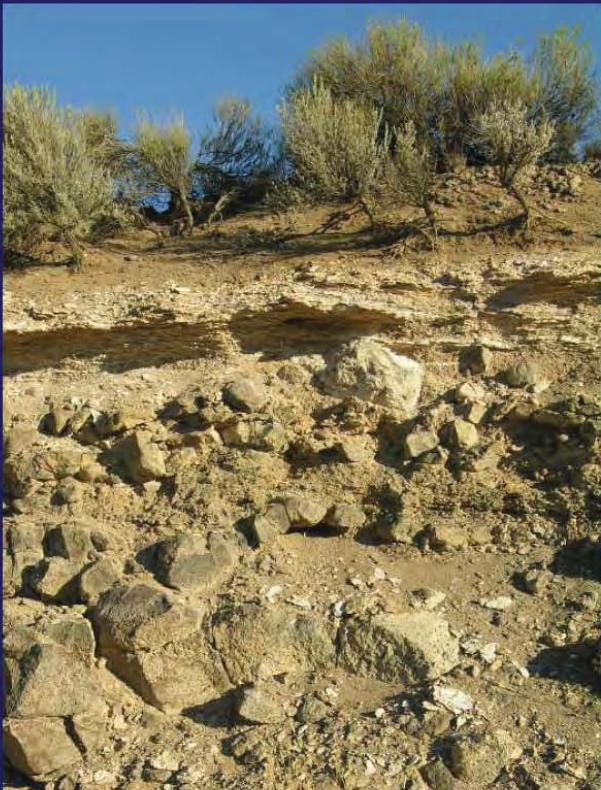
What Soil Is! What it does, how it works.

James Cassidy

Soii!!



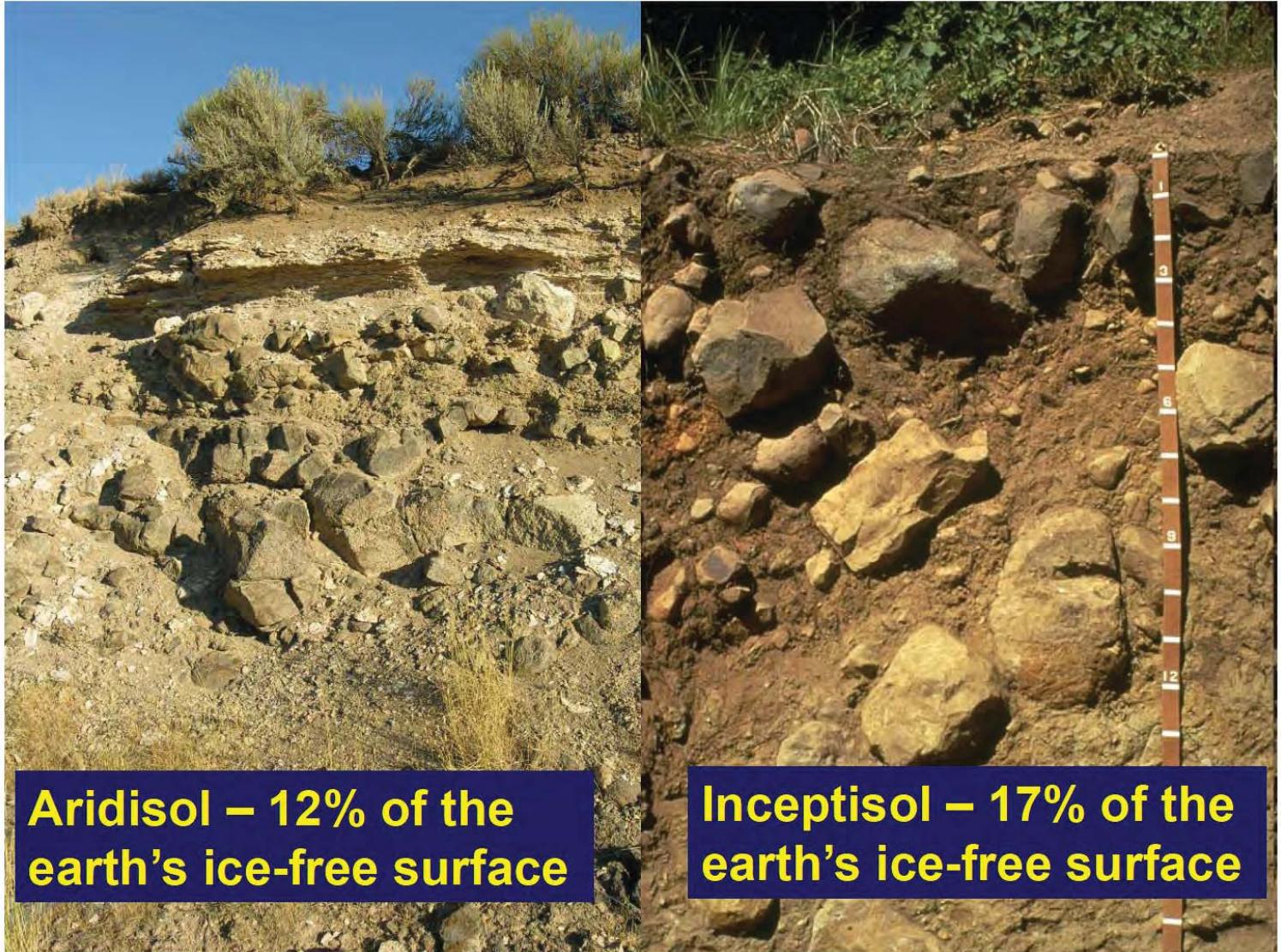
2 of the 12 Soil Orders



Aridisol



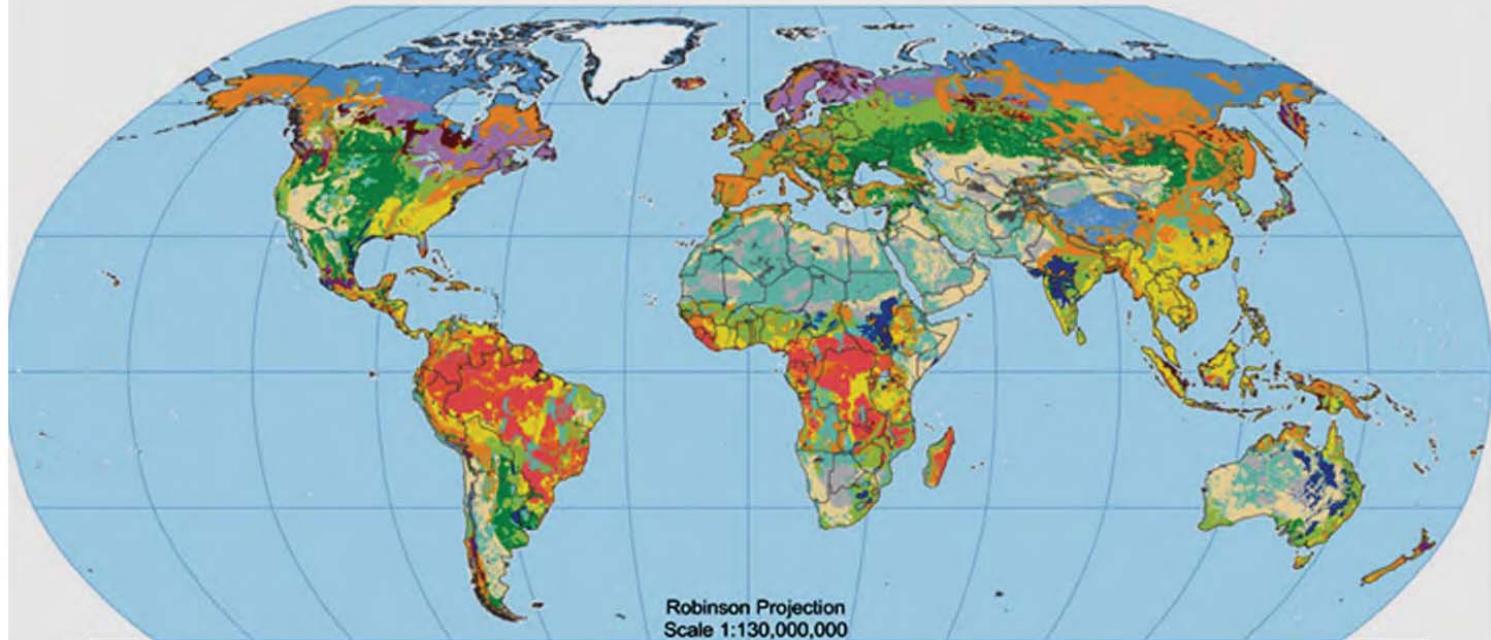
Mollisol



**Aridisol – 12% of the
earth's ice-free surface**

**Inceptisol – 17% of the
earth's ice-free surface**

Global Soil Regions



Soil Orders

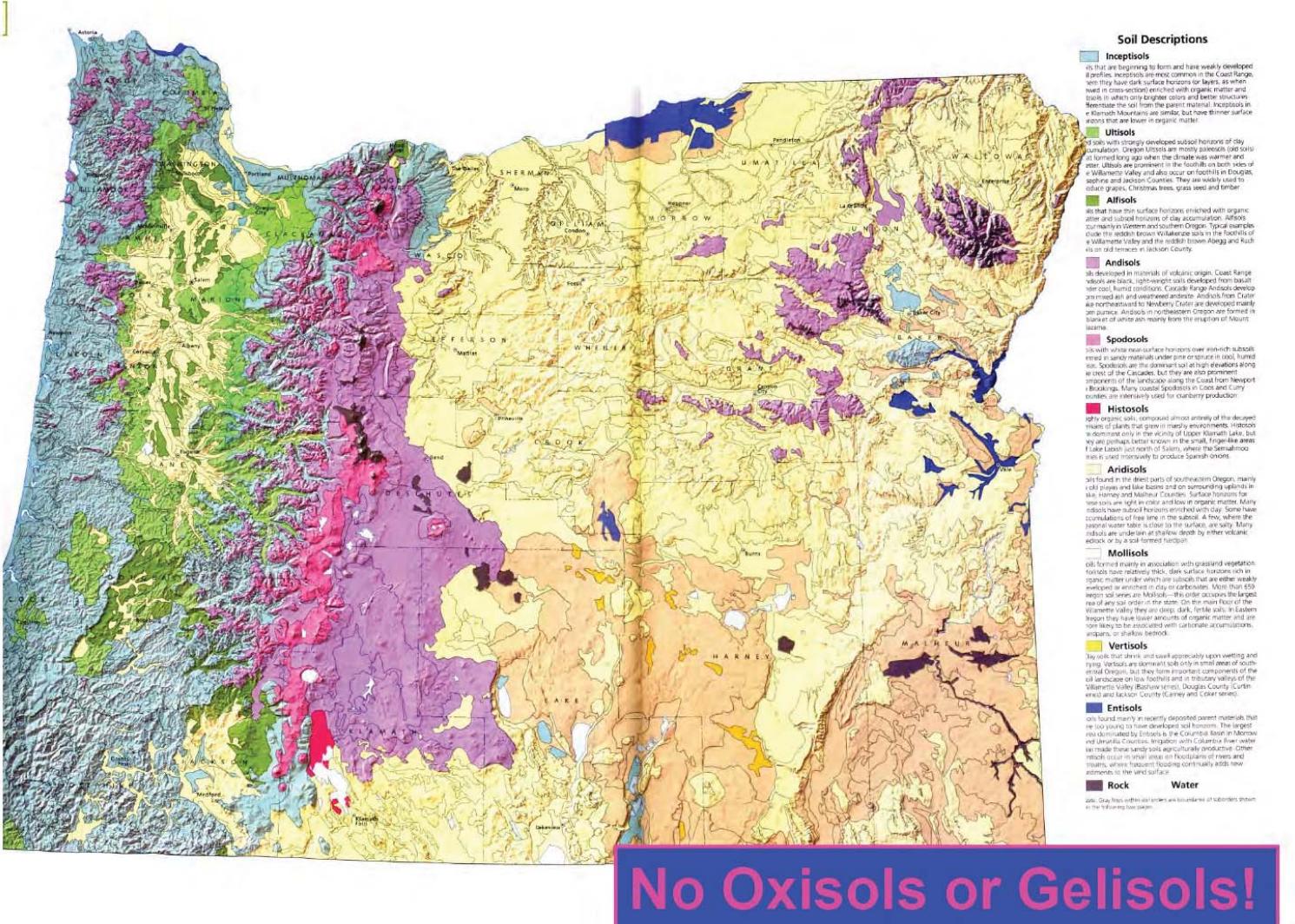
Alfisols	Entisols	Inceptisols	Spodosols	Rocky Land
Andisols	Gelisols	Mollisols	Ultisols	Shifting Sand
Aridisols	Histosols	Oxisols	Vertisols	Ice/Glacier



US Department of Agriculture
Natural Resources
Conservation Service

Soil Survey Division
World Soil Resources
soils.usda.gov/use/worldsoils

November 2005



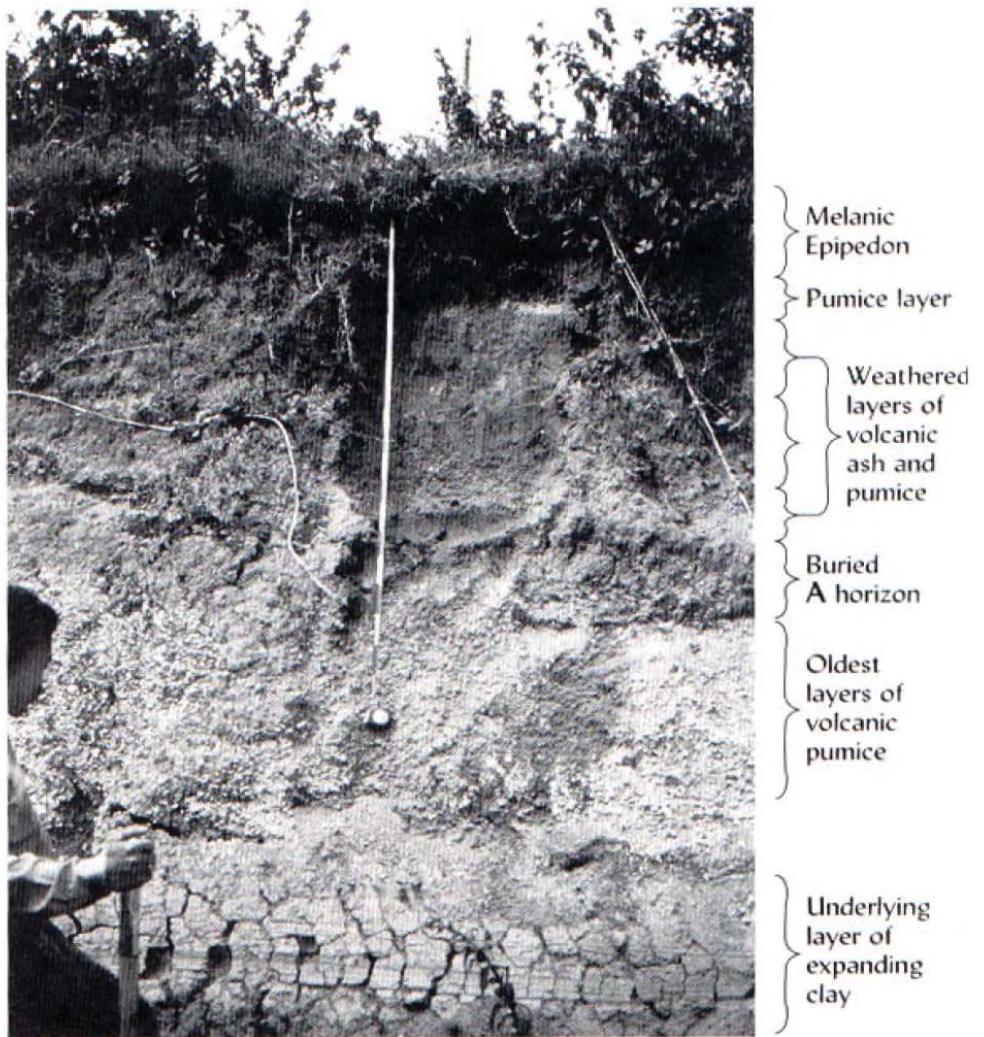
No Oxisols or Gelisols!

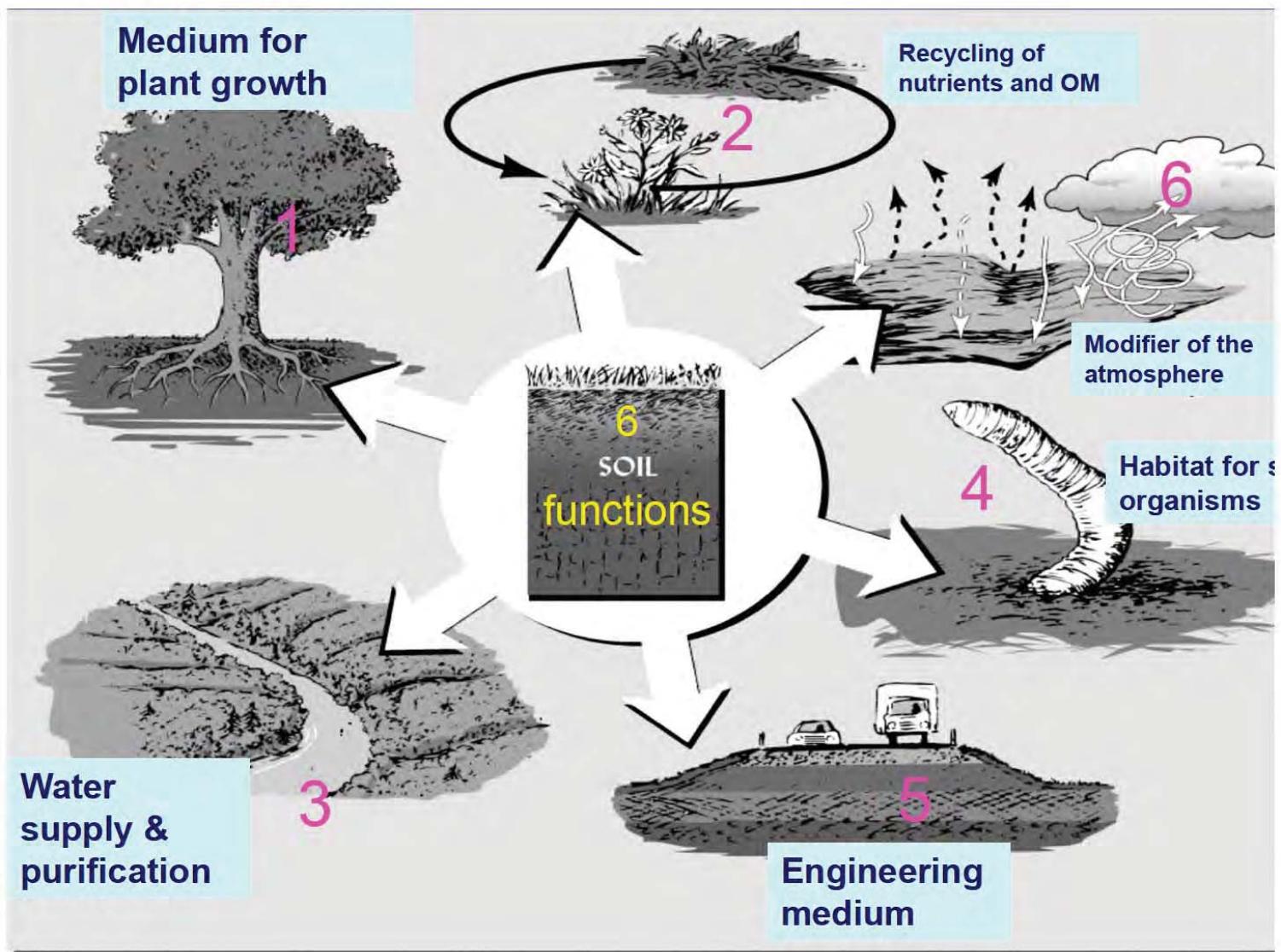


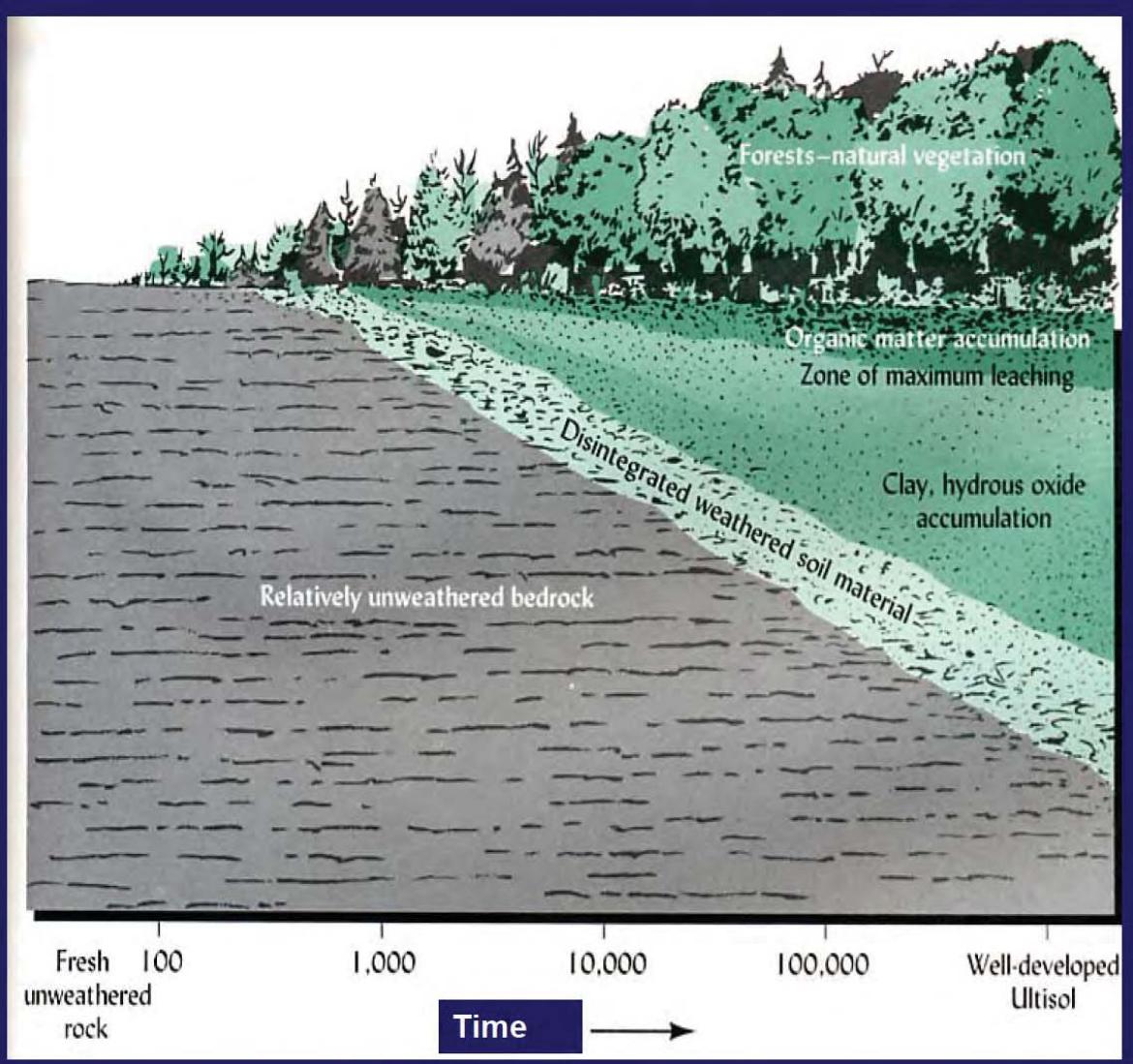
**Spodosol
Oregon Coast**

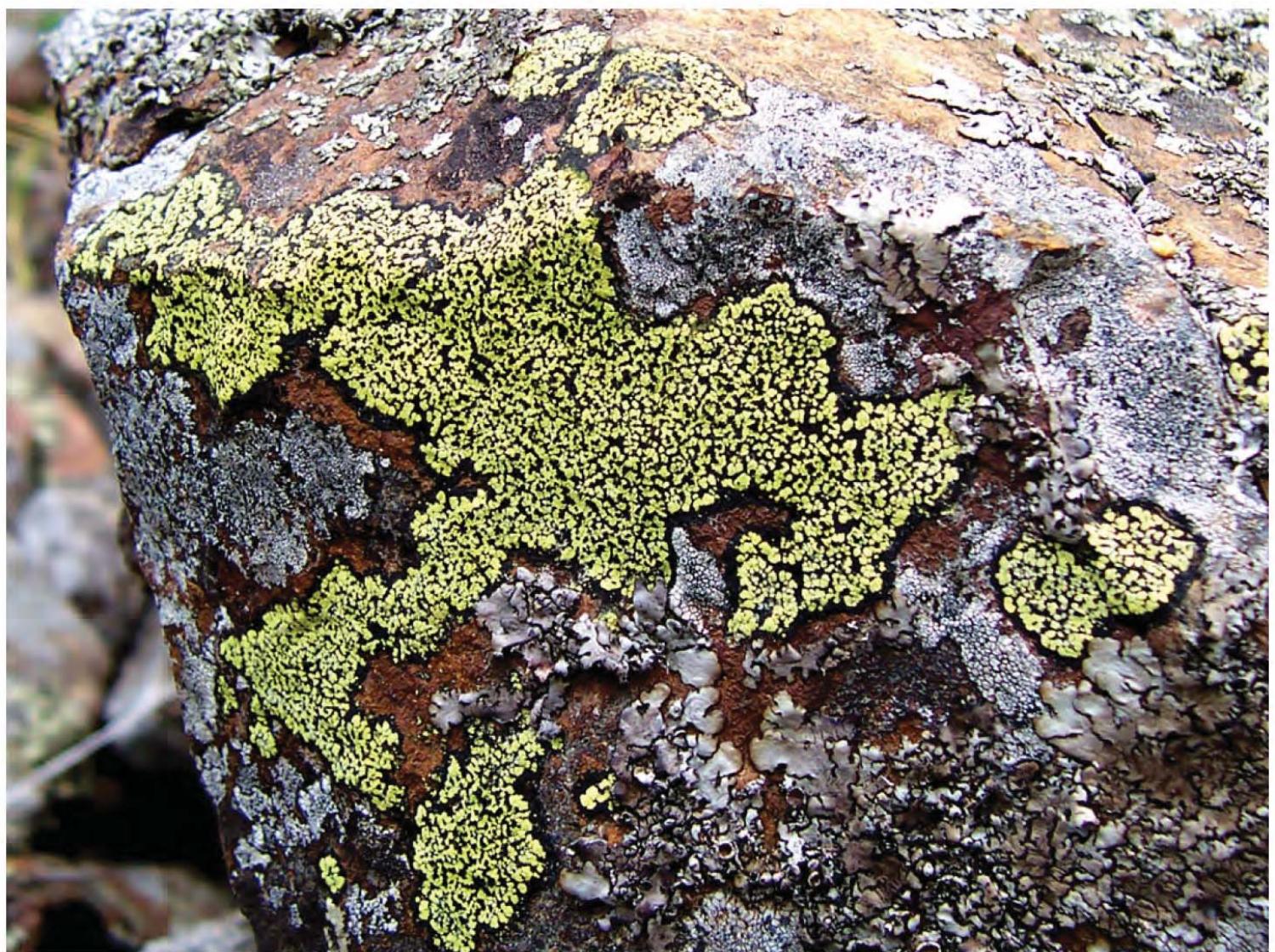
Andisols

Central Africa





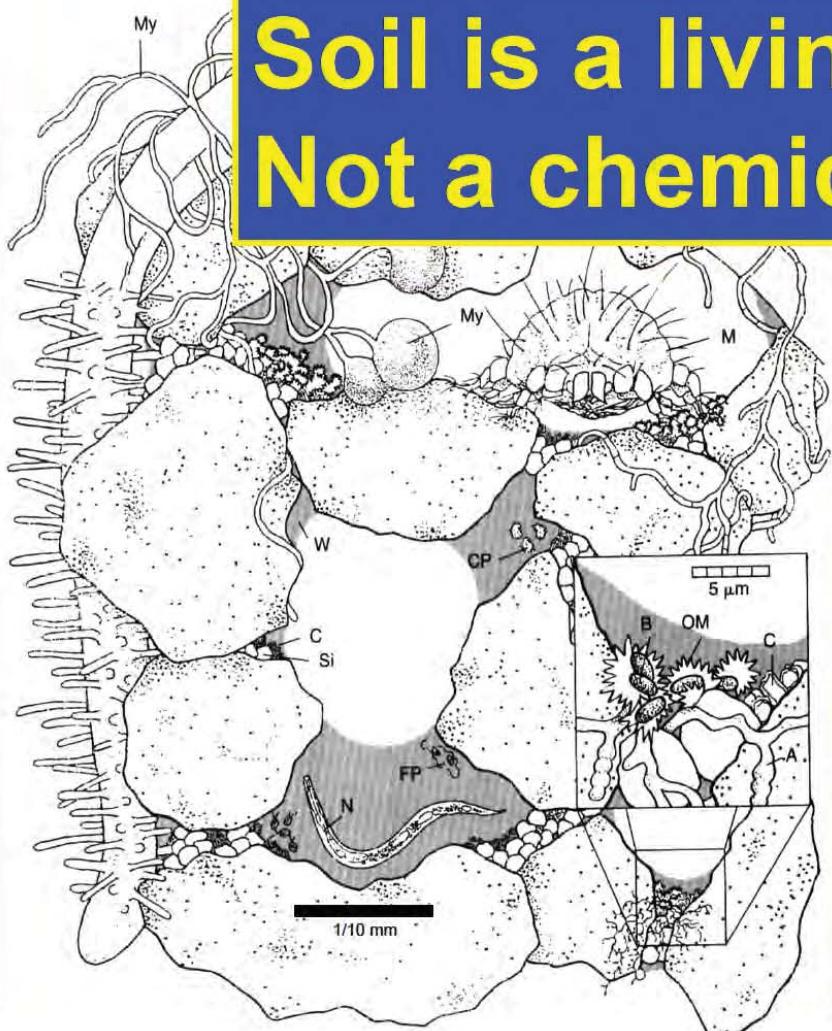






Soil is habitat!

Soil is a living thing! Not a chemical sponge!



B – Bacteria
A – Actinomycetes
My – Mycorrhizae
H – Saprophytic fungus
N – Nematode
CP – Ciliate protozoa
FP – Flagellate protozoa
M – Mite

< 1mm

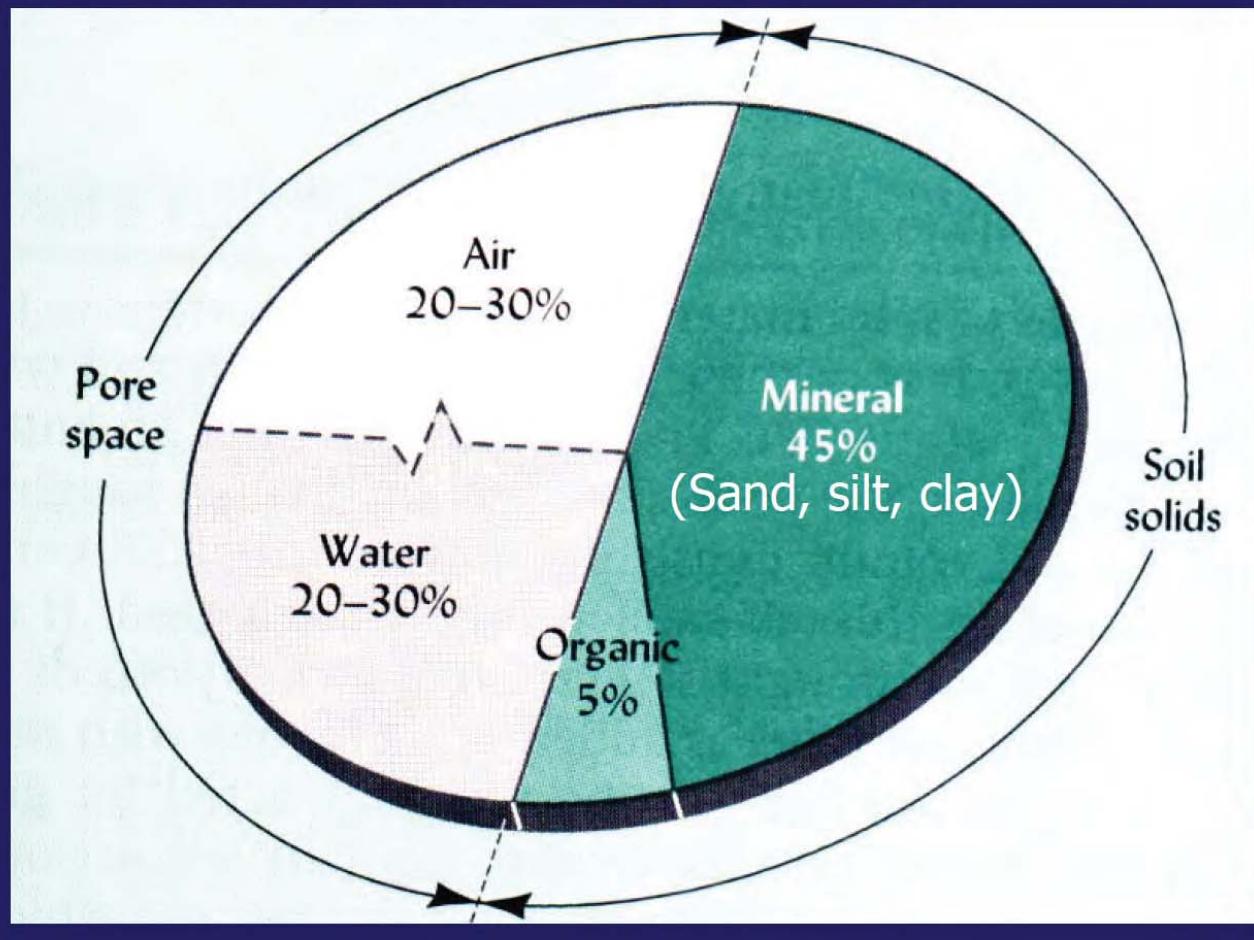
What is Soil?

Soil is:

- **“Rotted” Rock**
- **Decomposed Organic Matter**



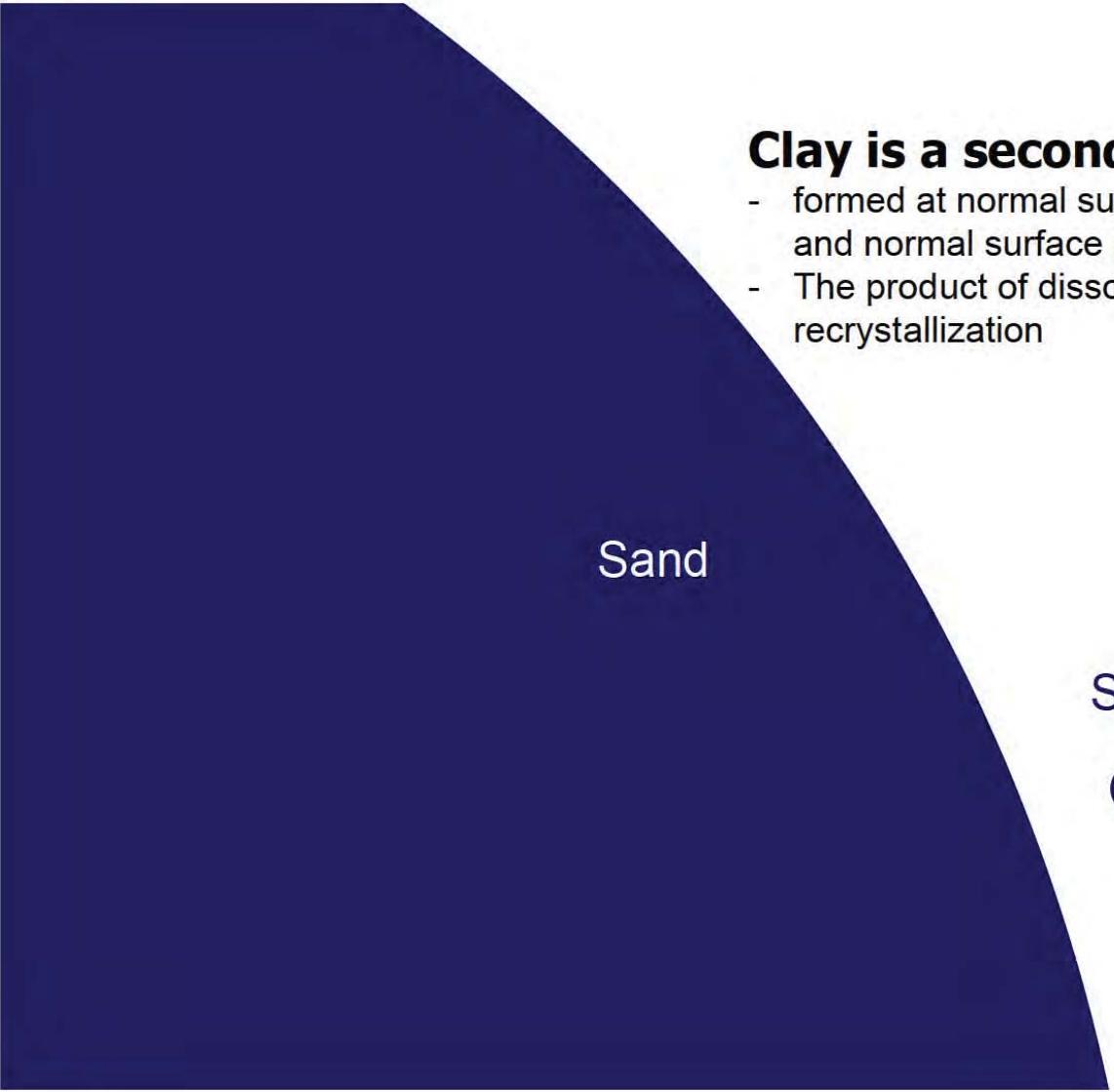
The four components of soil:



Rock – primary mineral

Granite





Clay is a secondary mineral

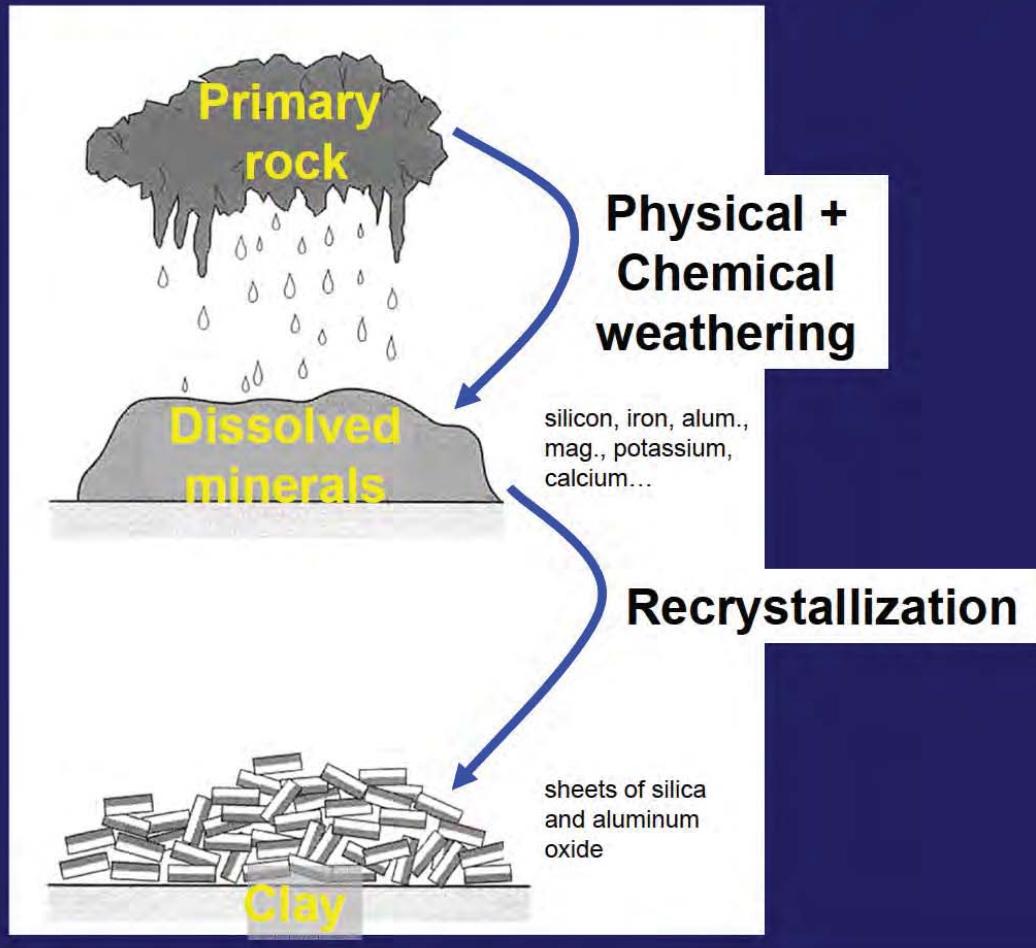
- formed at normal surface temperatures and normal surface pressures
- The product of dissolution and recrystallization

Sand

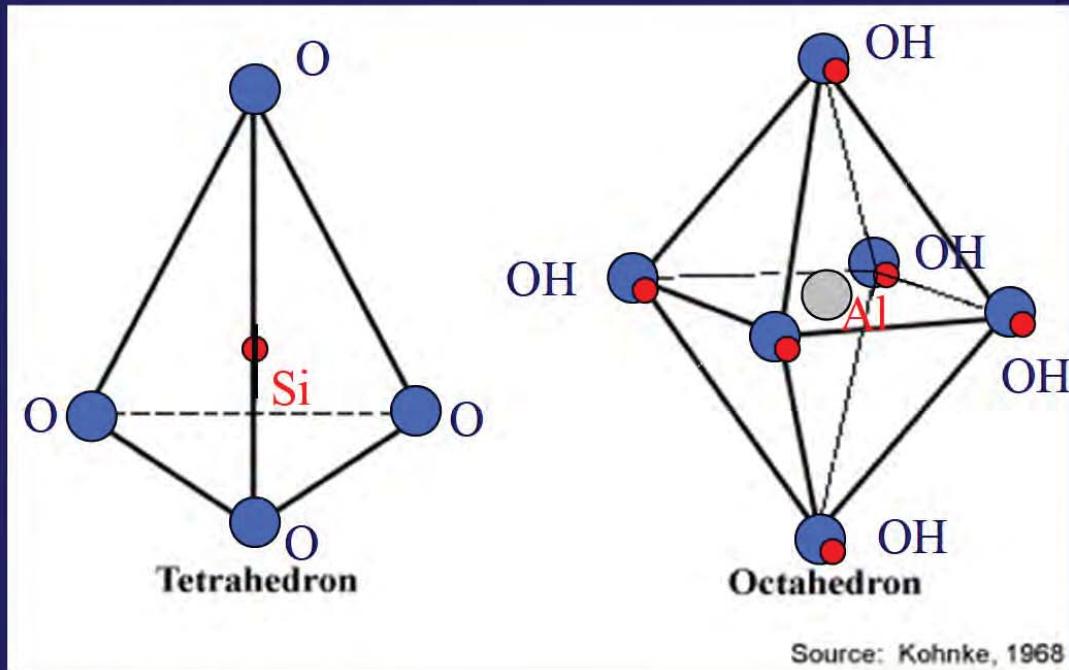
Silt

Clay

Rocks dissolve and recrystallize



When rocks dissolve...

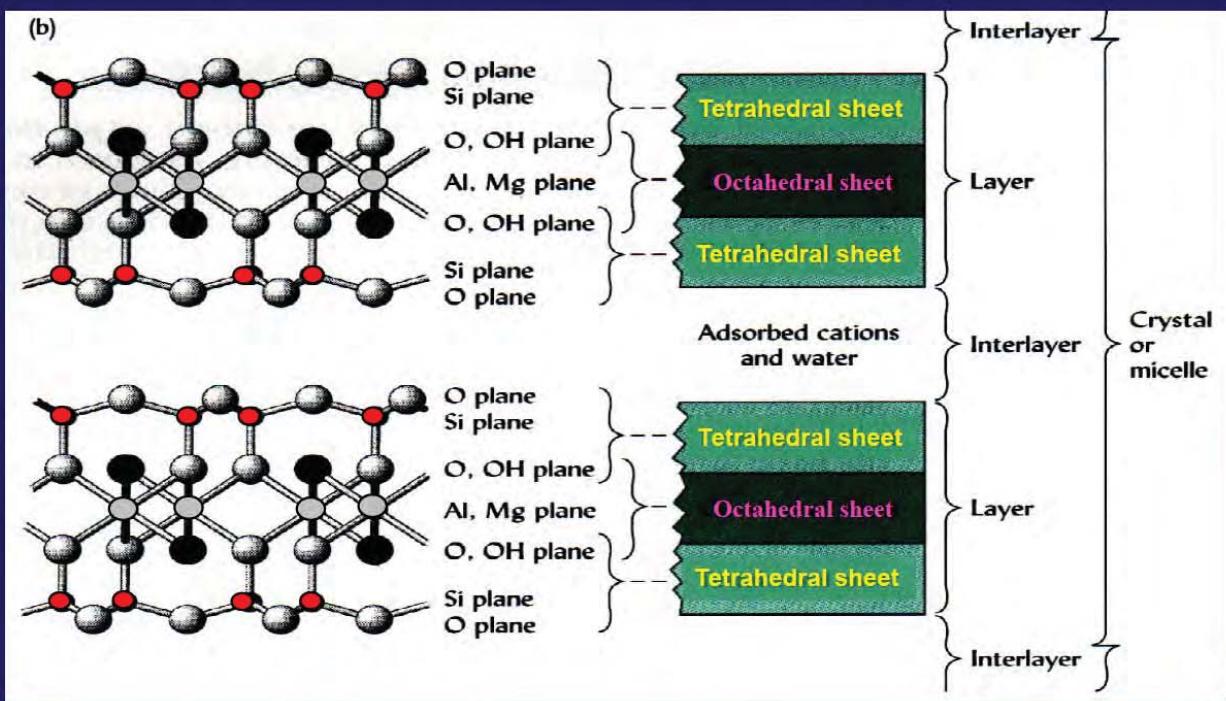


Tetrahedron - a 3D geometric form contained by four plane faces; a triangular pyramid.

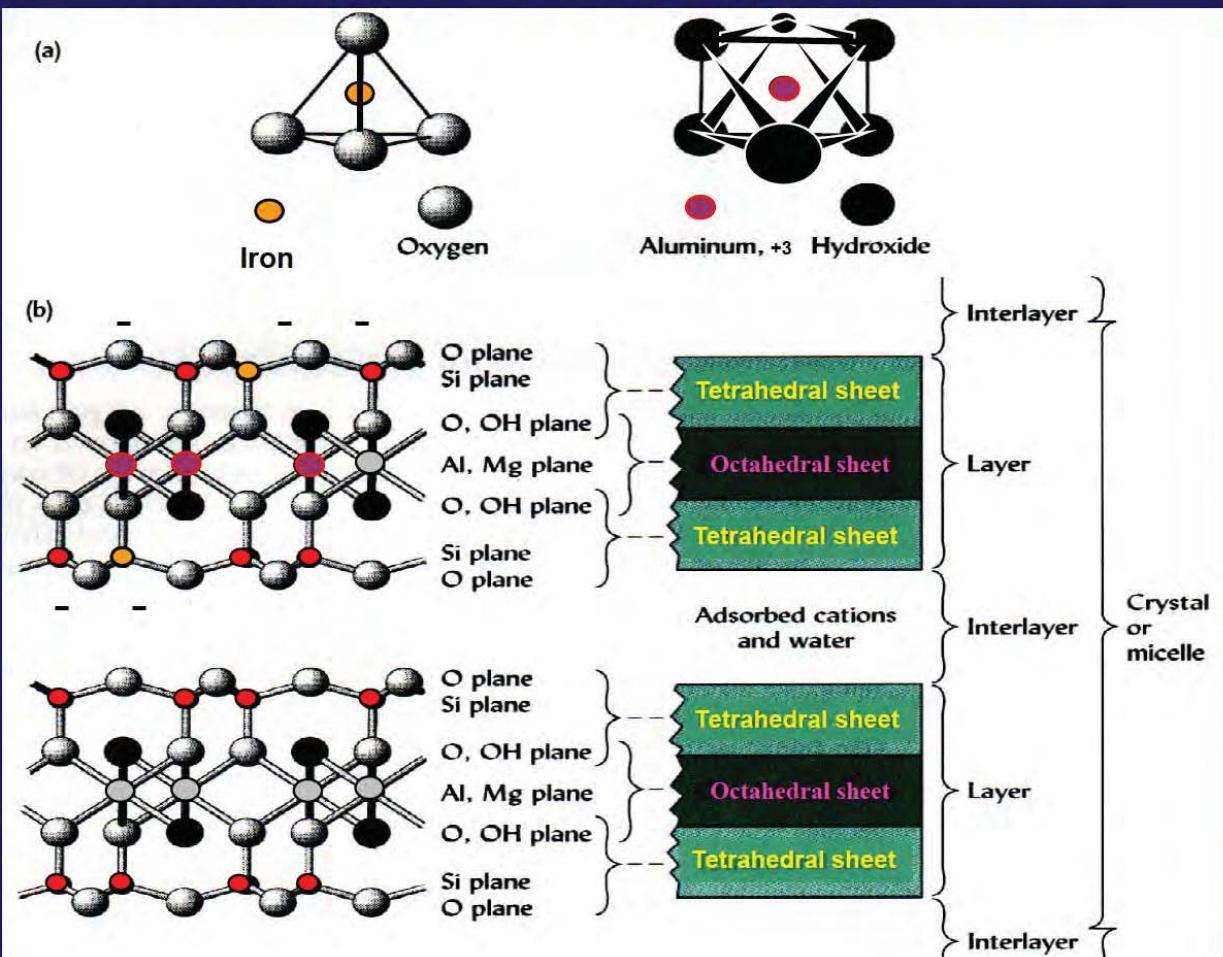
Octahedron - a 3D geometric form contained by eight plane faces.

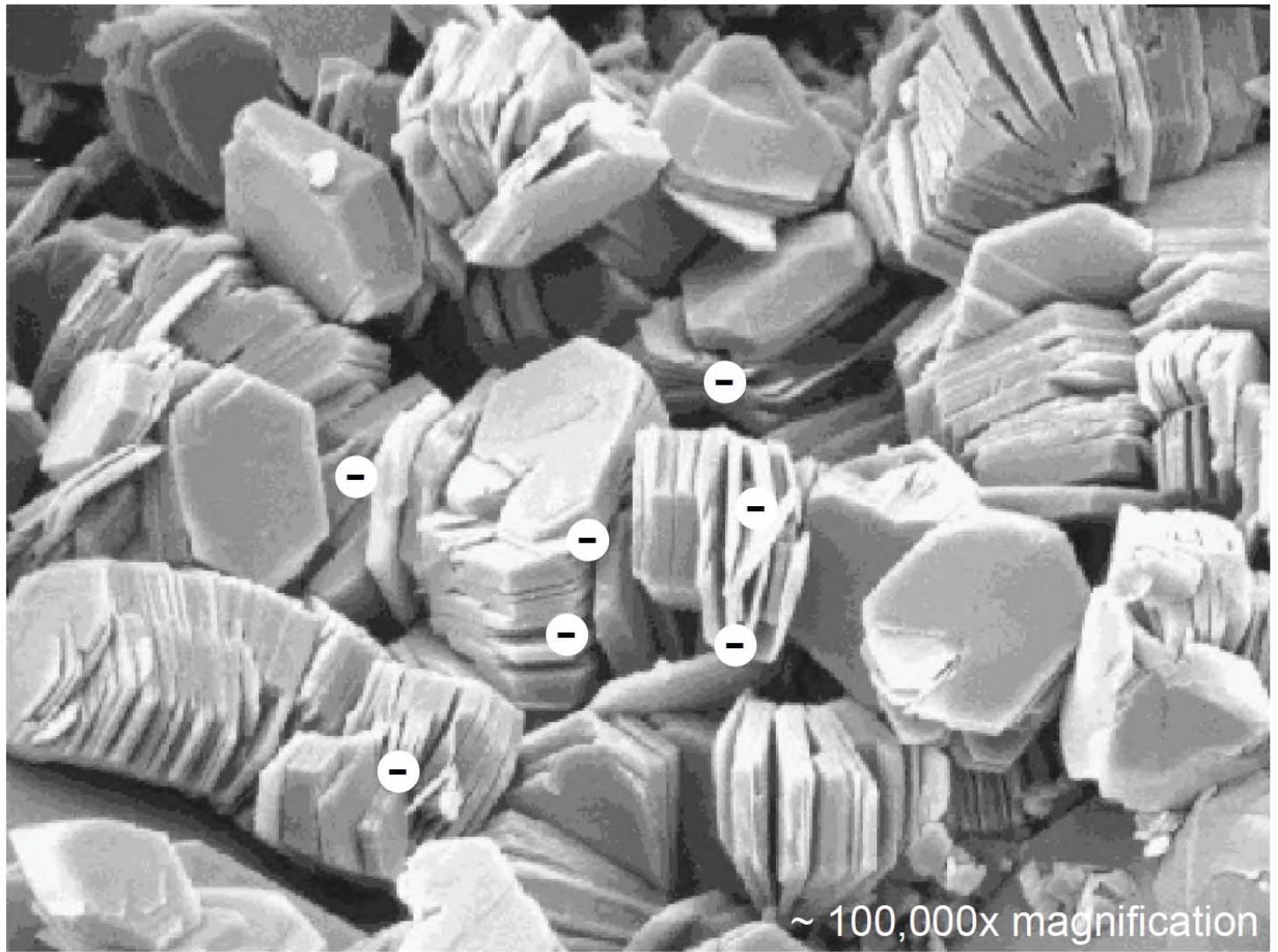
...and recrystallize.

Clay – secondary mineral



Isomorphic Substitution... one source of charge in soils

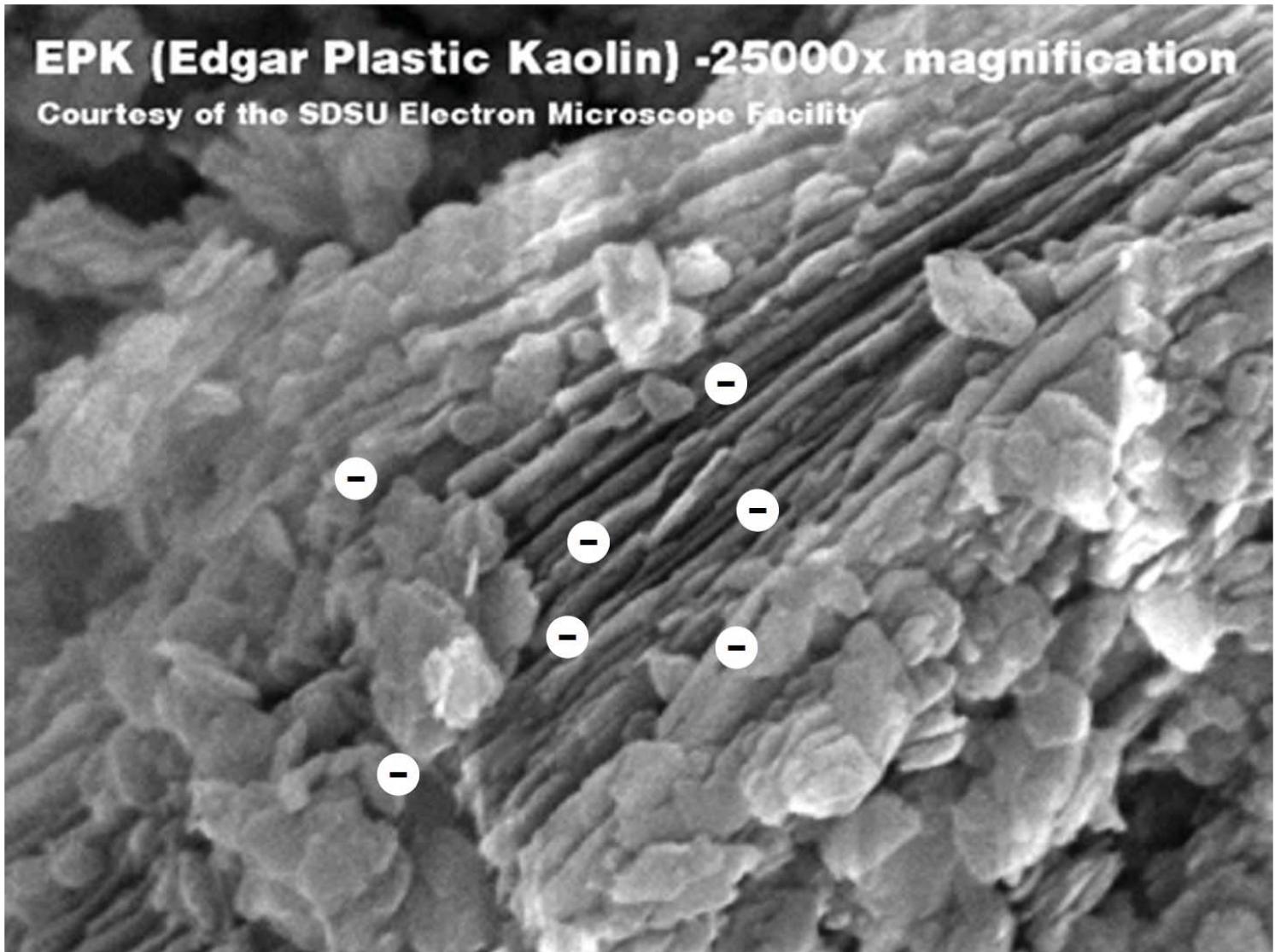


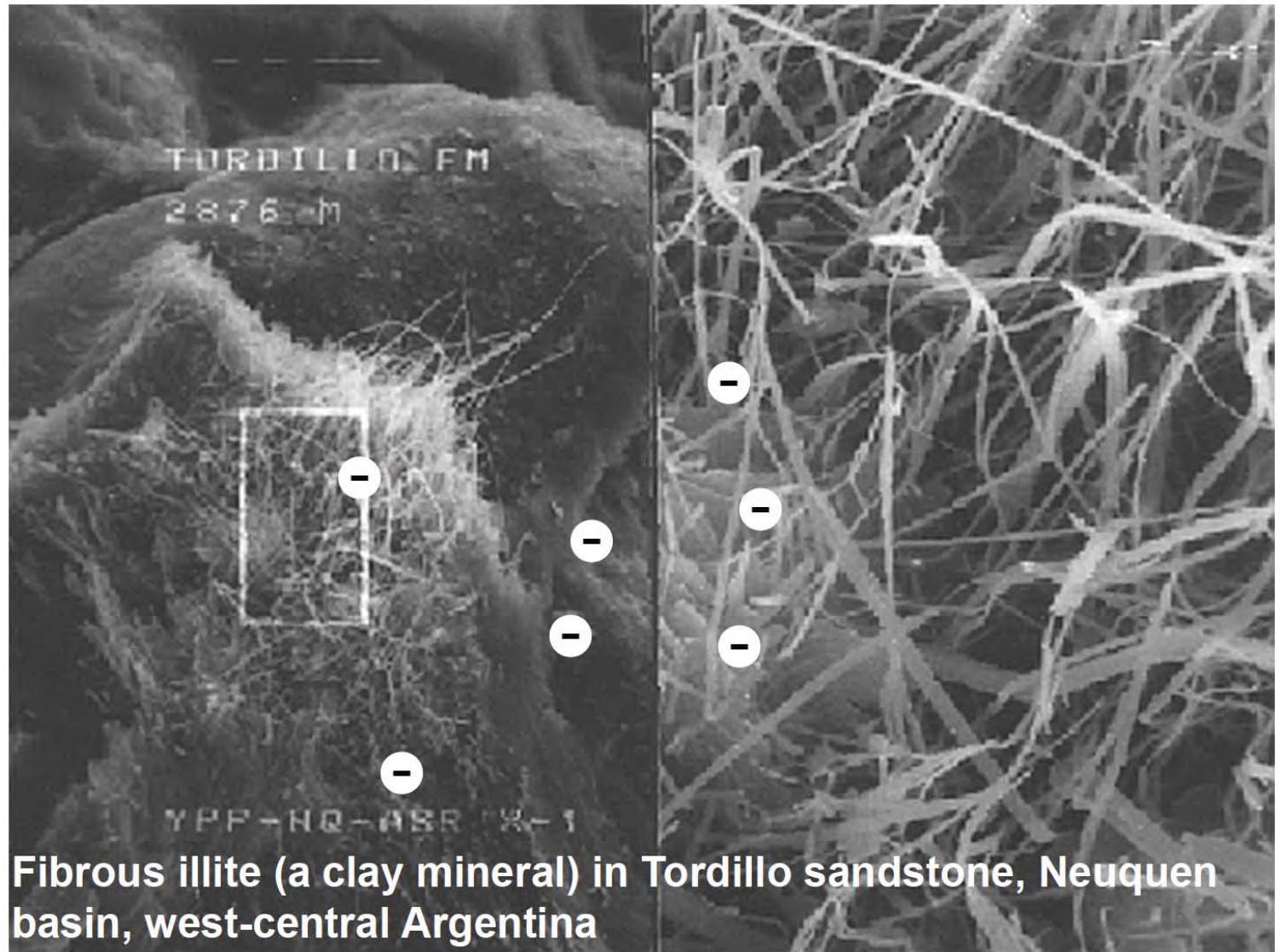


~ 100,000x magnification

EPK (Edgar Plastic Kaolin) -25000x magnification

Courtesy of the SDSU Electron Microscope Facility



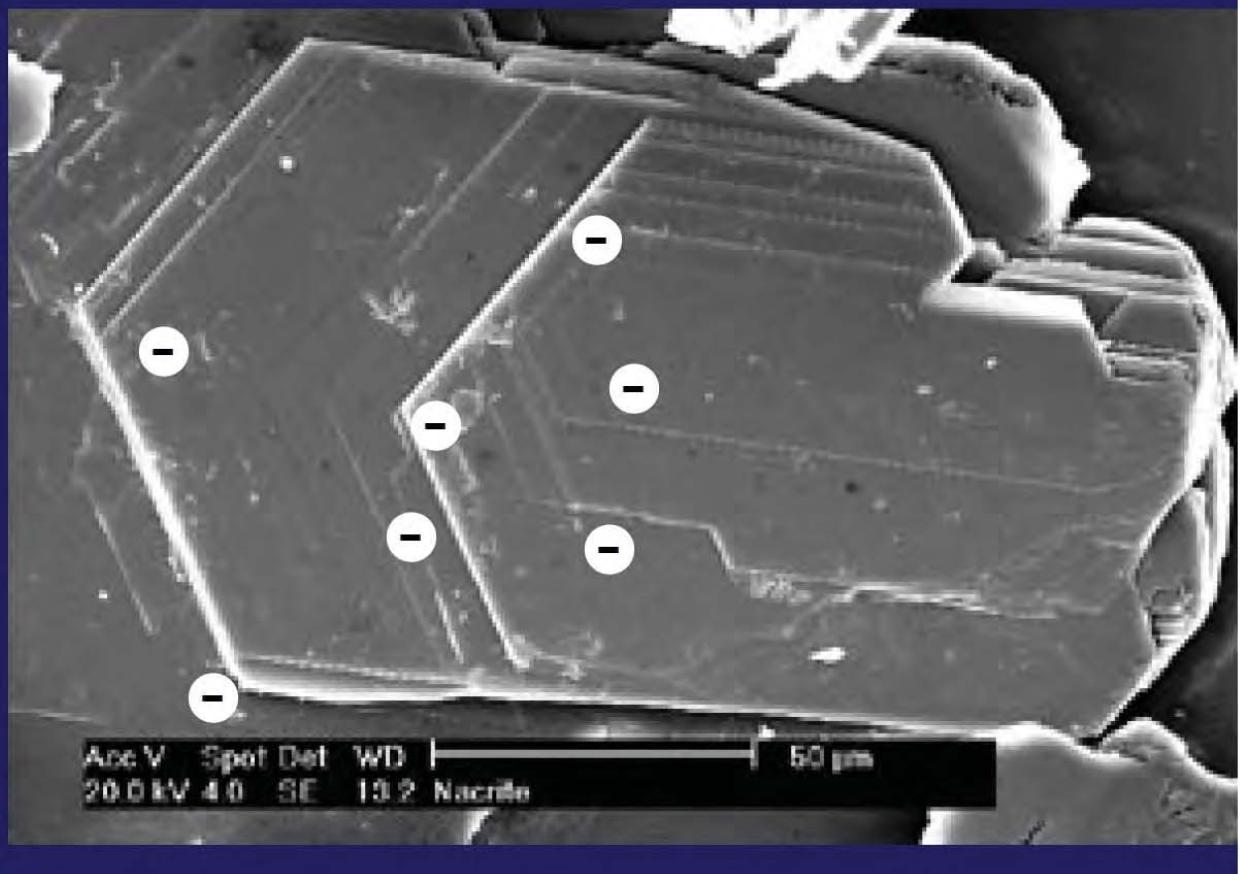


Fibrous illite (a clay mineral) in Tordillo sandstone, Neuquen basin, west-central Argentina

Nacrite

**Nacrite,
Lodèv
Basin,
France**

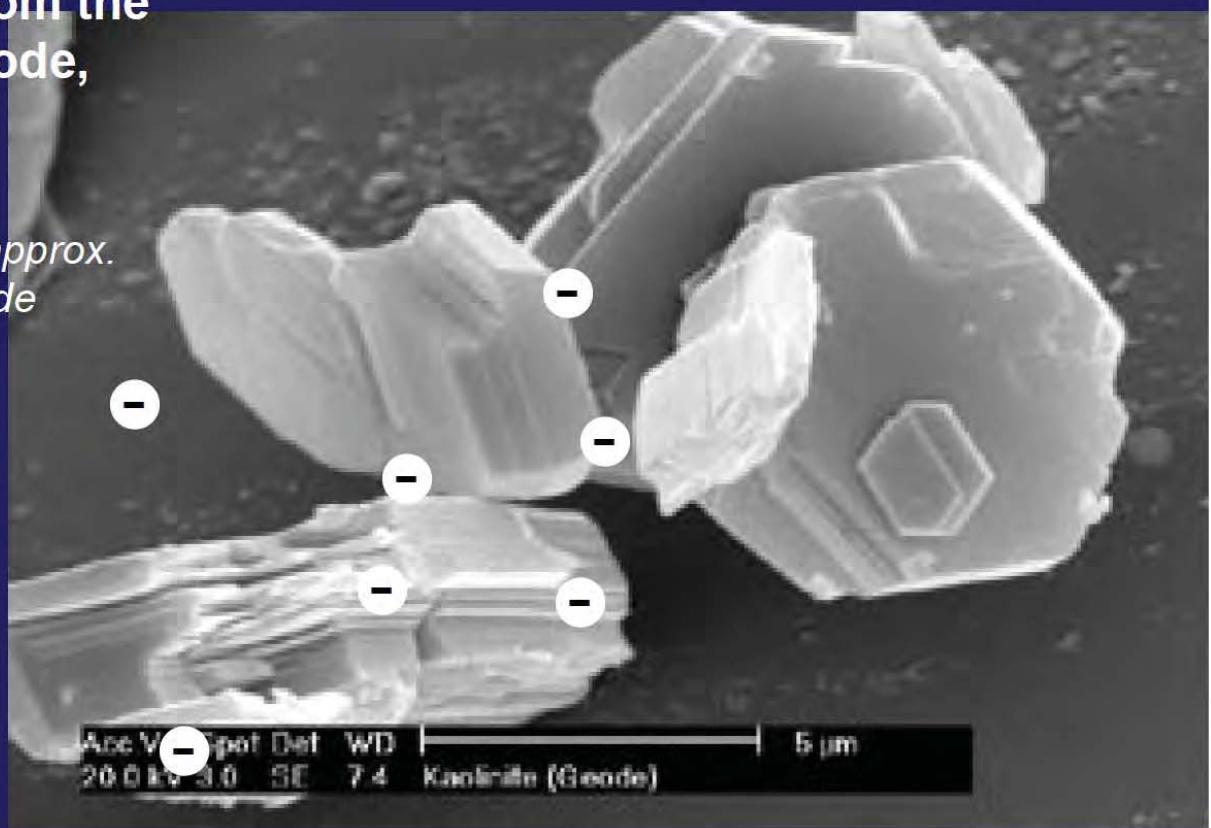
*Field of view
approx. 200
microns
wide*

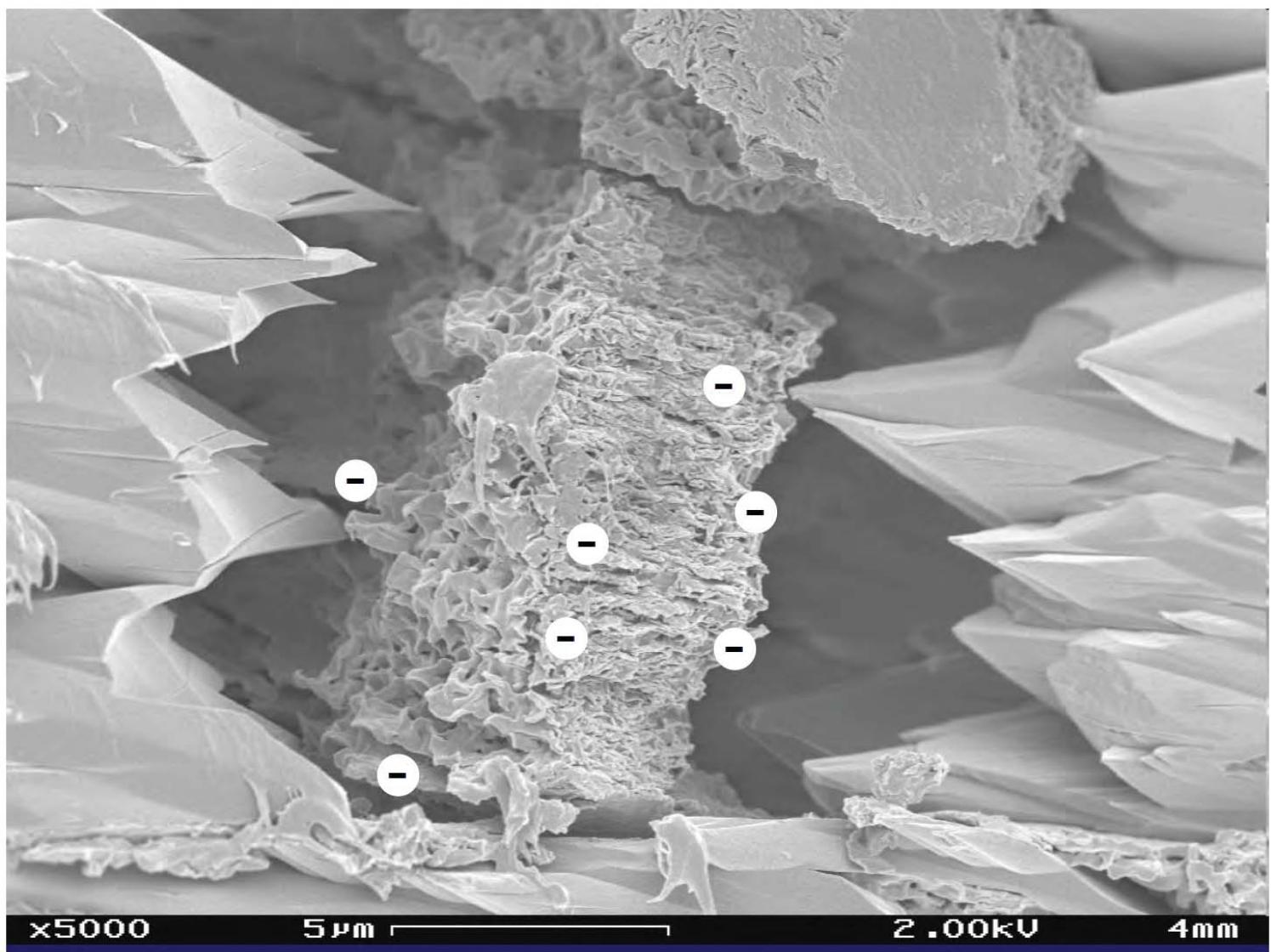


Kaolinite

**Well crystallized
kaolinite from the
Keokuk geode,
USA**

*Field of view approx.
18 microns wide*





Clay

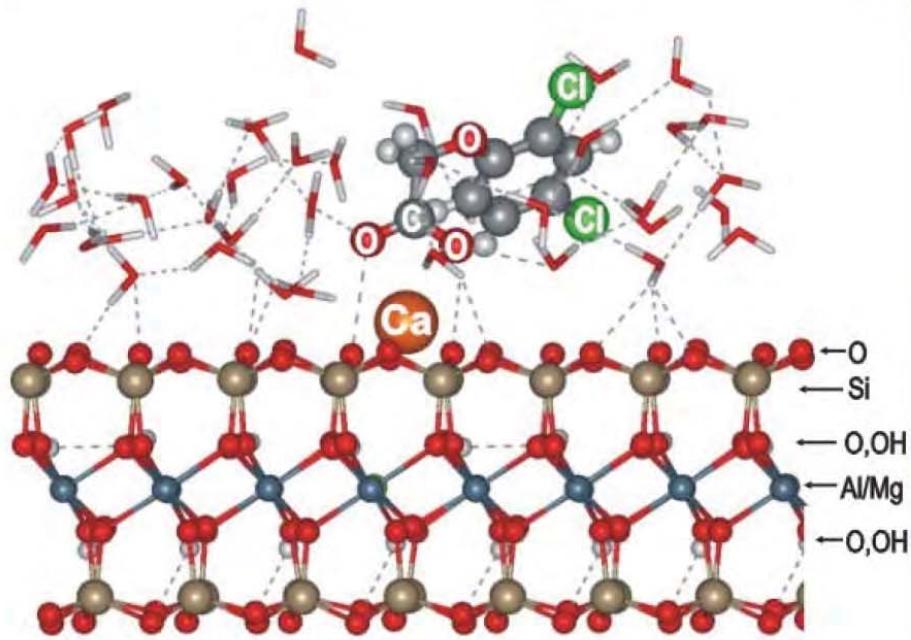
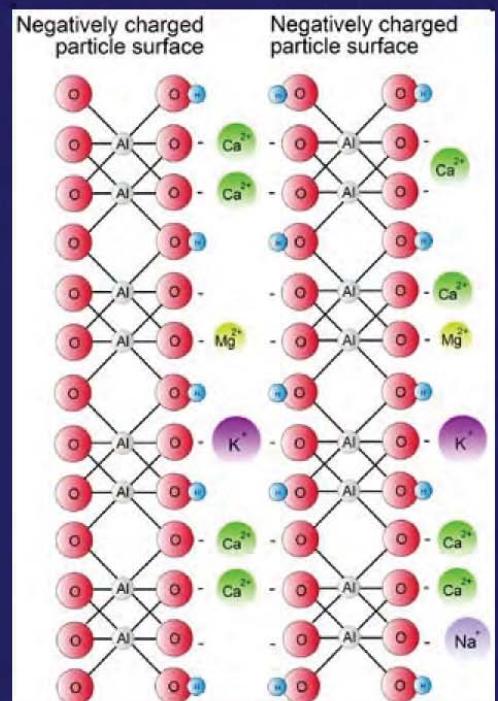


Fig.1 Hydrated pesticide 2,4-D, adsorbed on Montmorillonite surface via Ca^{2+} cation.

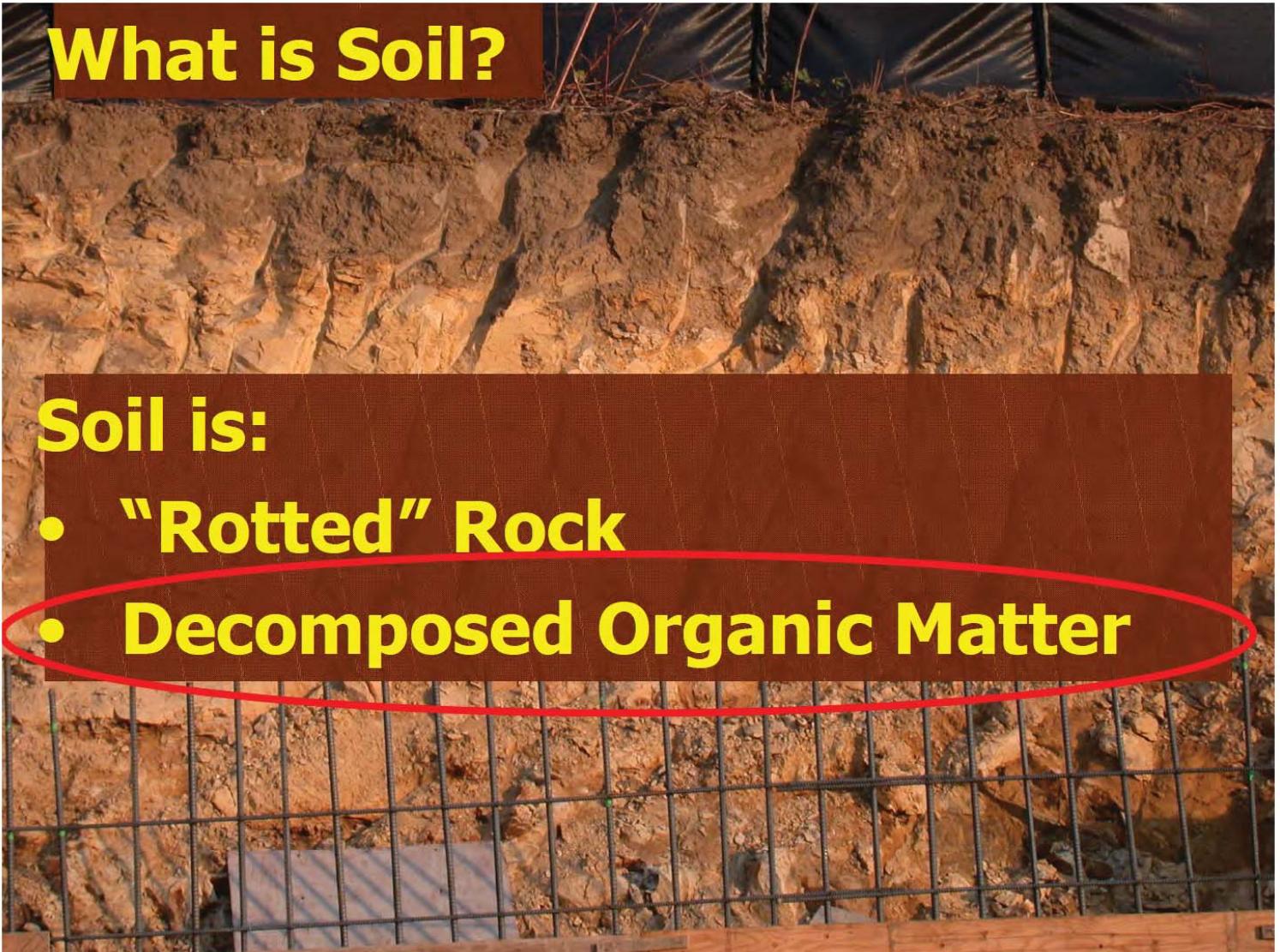


http://virtual-museum.soils.wisc.edu/soil_smectite/index.htm

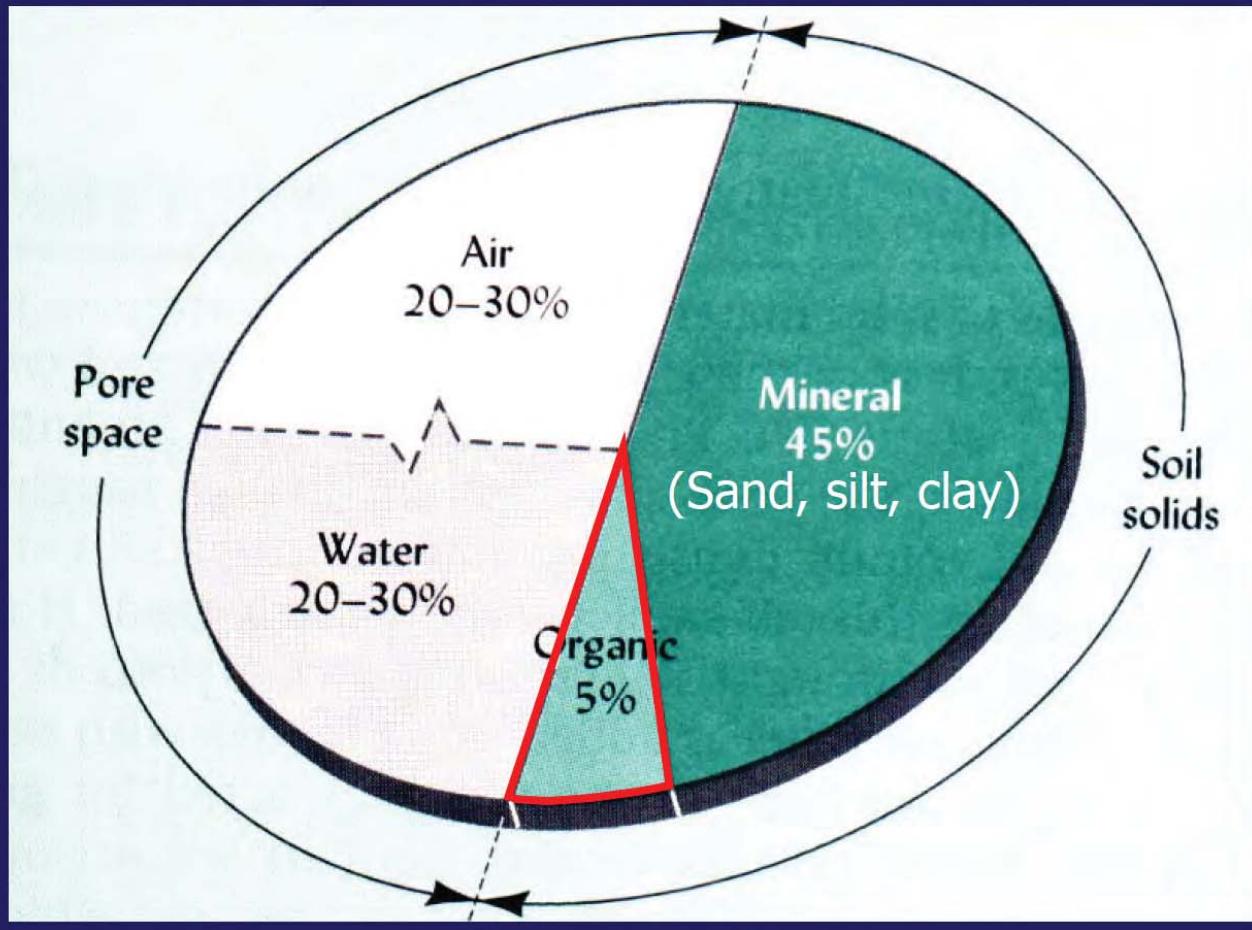
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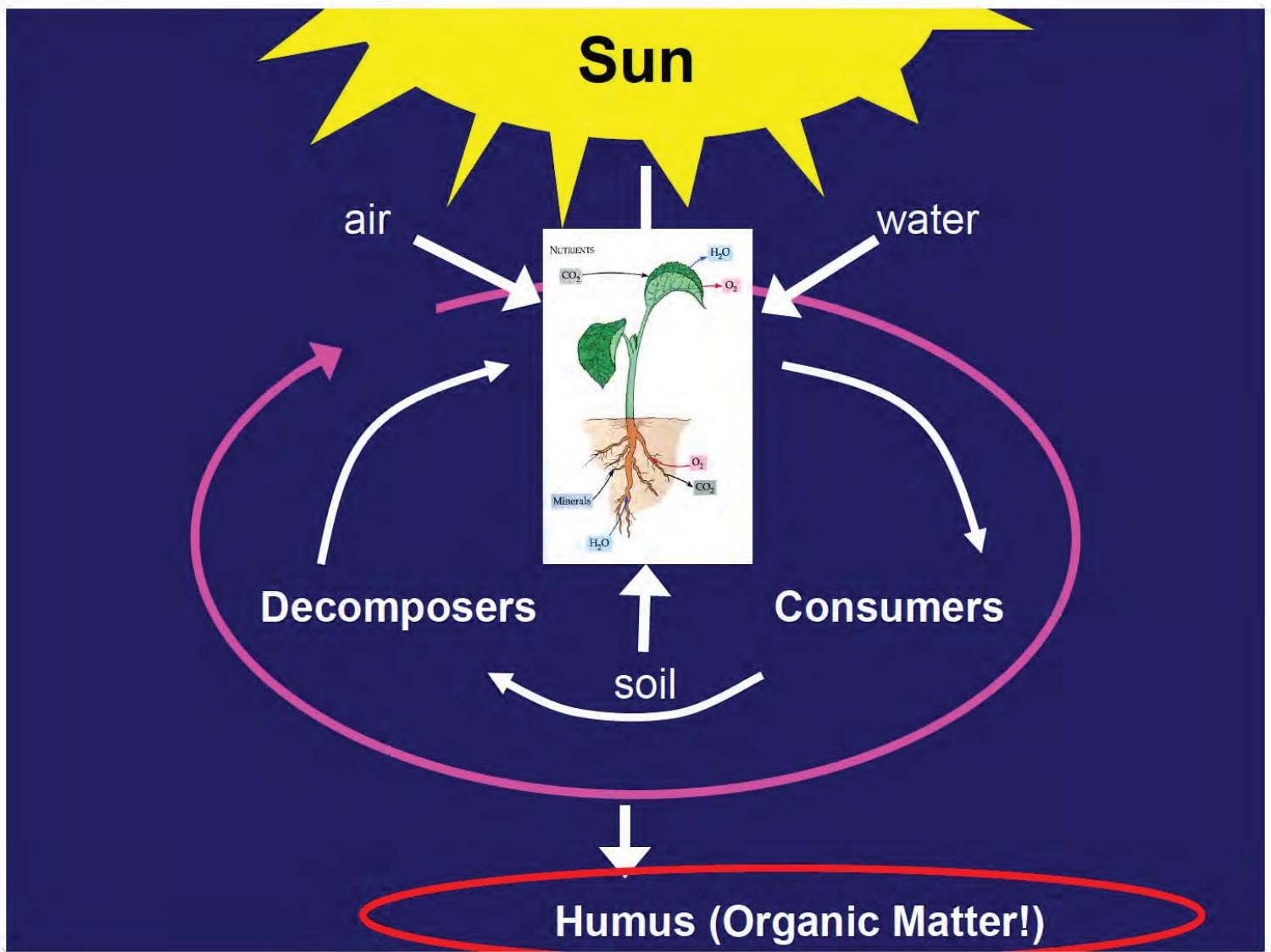
Soil is:

- “Rotted” Rock
- Decomposed Organic Matter



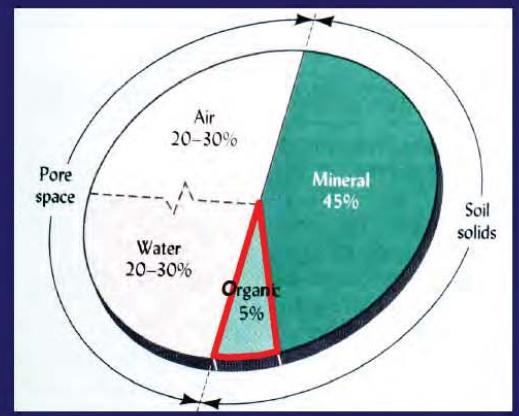
What is Organic Matter?



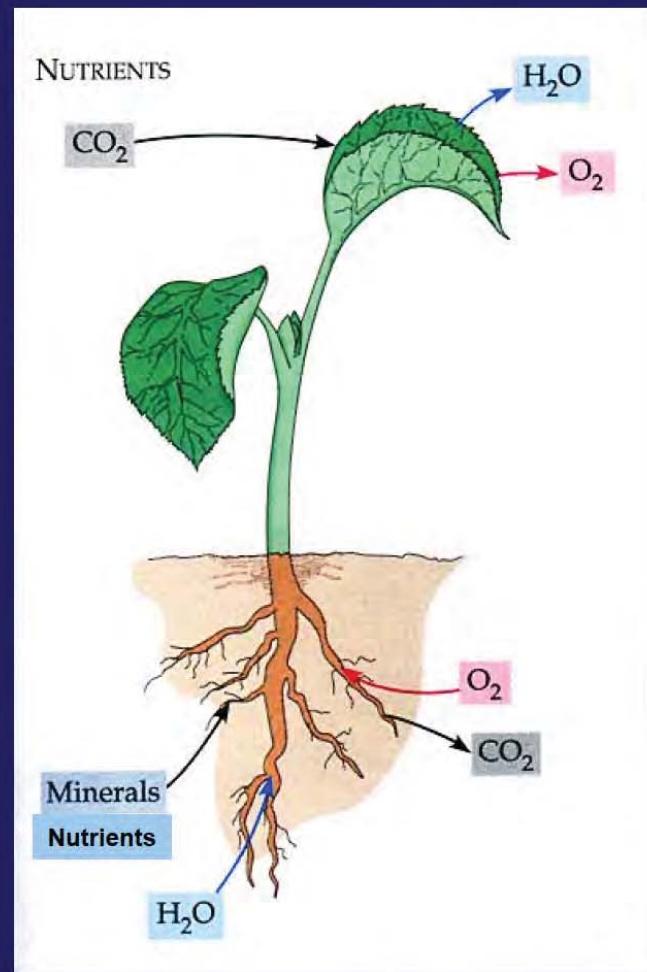


Functions of Organic Matter

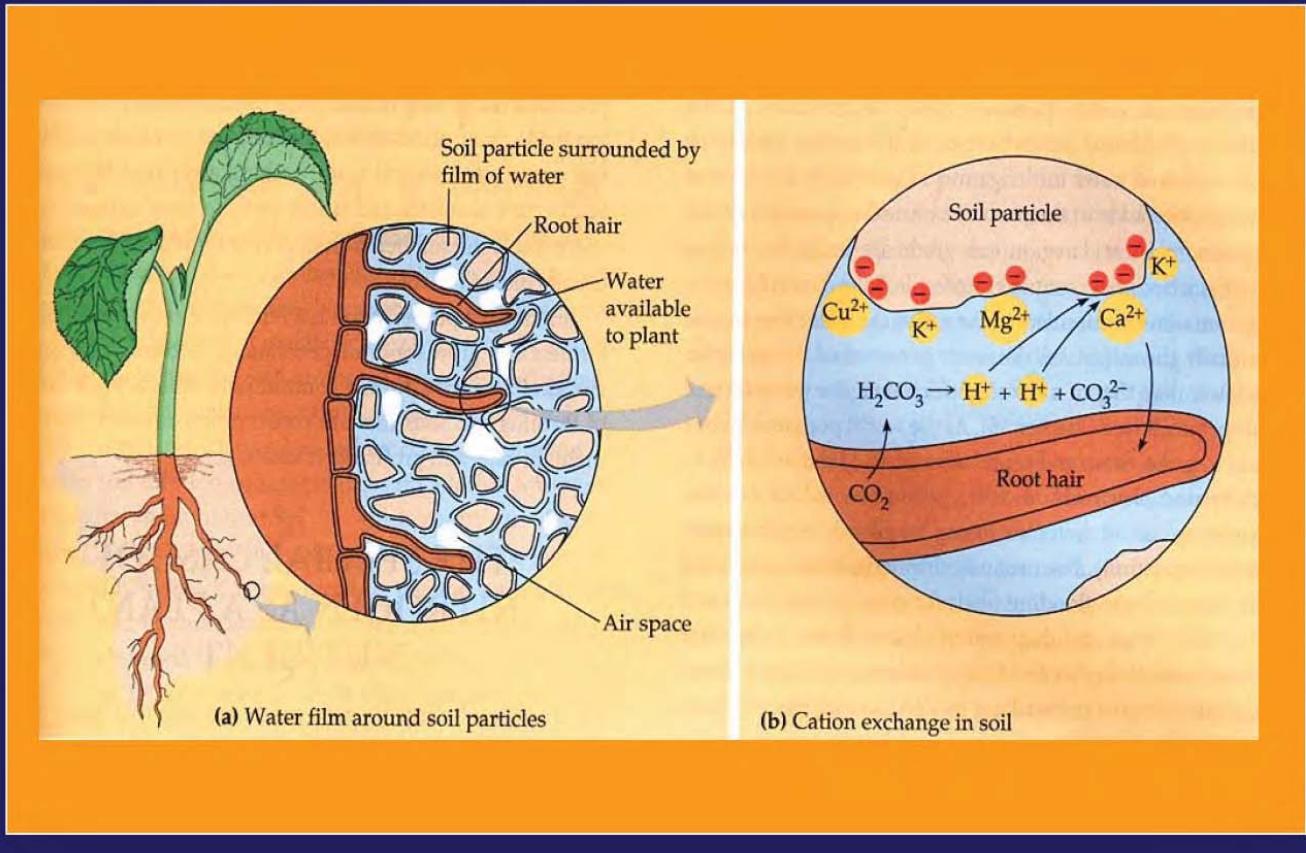
Organic Matter
**...provides another source of charge
in soils – twice that of clay!**



How a plant works



How a plant works



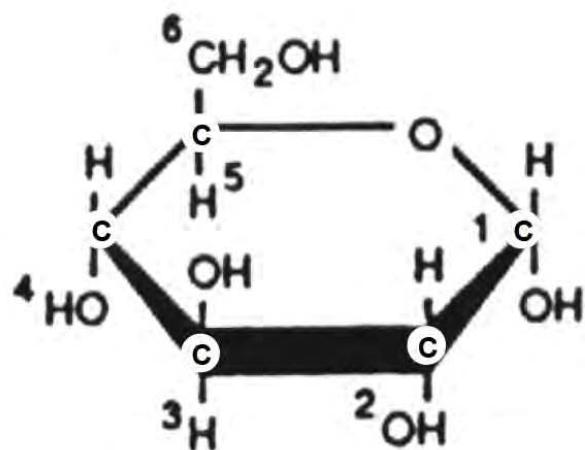


Chemical composition of plant matter

- Sugars, starches, simple proteins **fast**
 - Crude proteins
 - Hemicellulose
 - Cellulose
 - Fats, waxes
 - Lignin
- 
- slow**

Sugar – the first thing to breakdown and the fastest to do so

- Glucose structure -



D-Glucose

Cellulose Structure

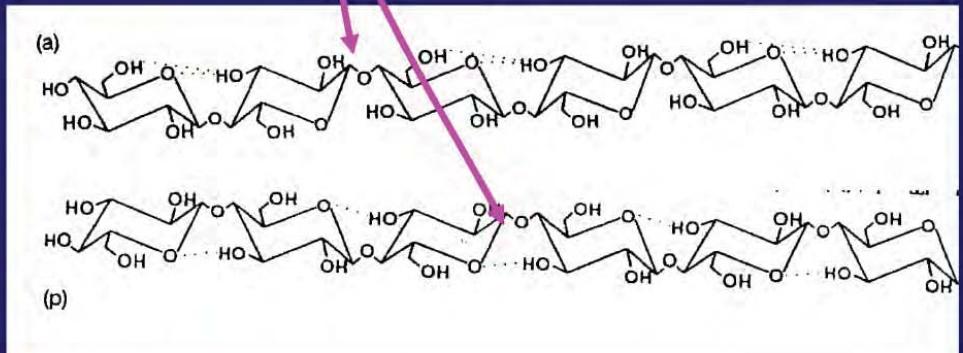
(and similarly, starches)

- Simple, repeating structure
 - Polymer of Glucose units
 - “Easy” to decompose

one, identically repeated, bond

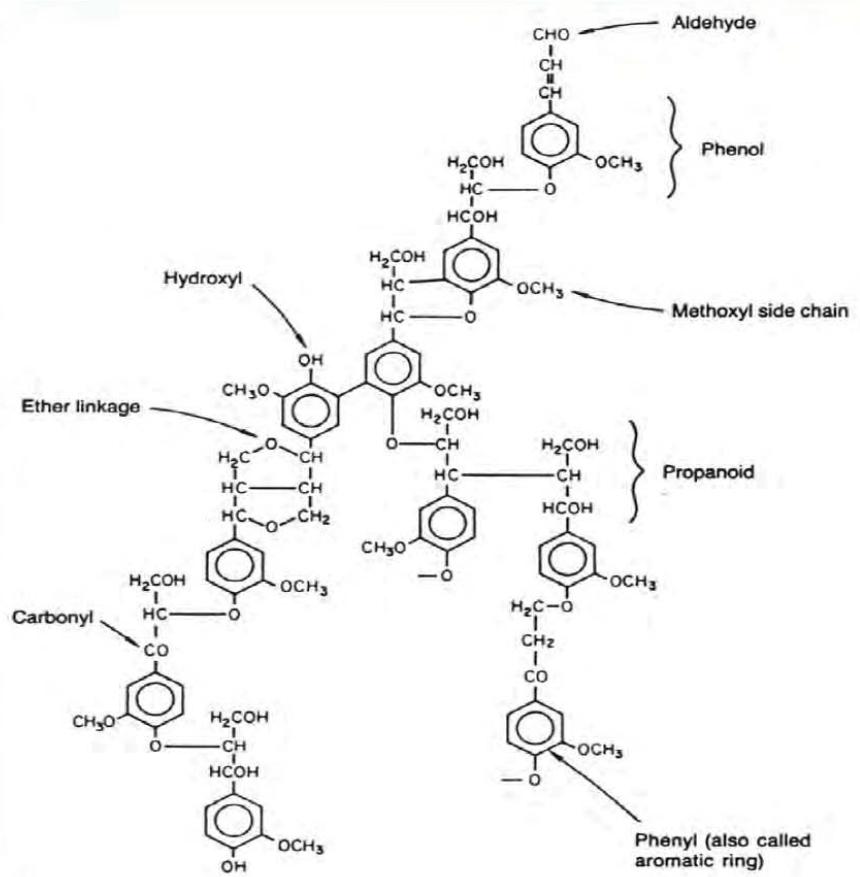
cellulose
(structural molecule)

starch
(energy storage molecule)



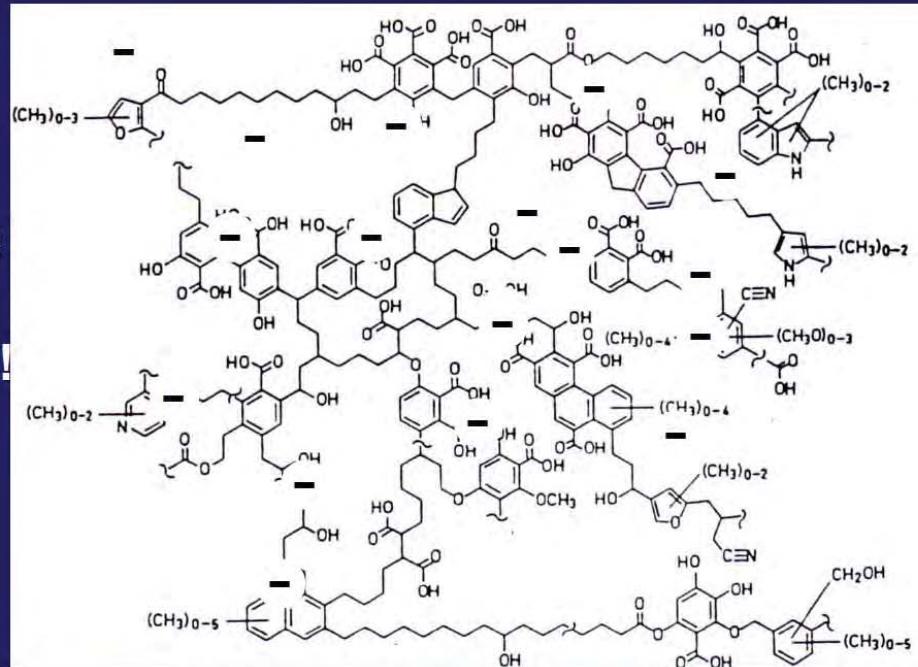
Lignin structure

- Complex, non-repeating structure
 - Harder to decompose
 - Need lots of enzymes to do it
 - “community decomposition”



Humus structure

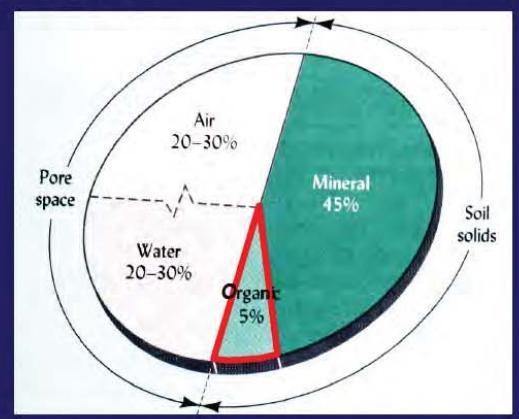
- Complex, non-repeating random structure
 - Has lots of negative charge!!!



It takes a village to decompose humus!

Functions of Organic Matter

1. **Carbon and energy** - for soil organisms
2. **Provides nutrient storage!** – negative charge – twice that of clay!
3. **Structure** - Stabilizes soil structure, making soil easily managed – **SOIL GLUE!**





Soil “structure”