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

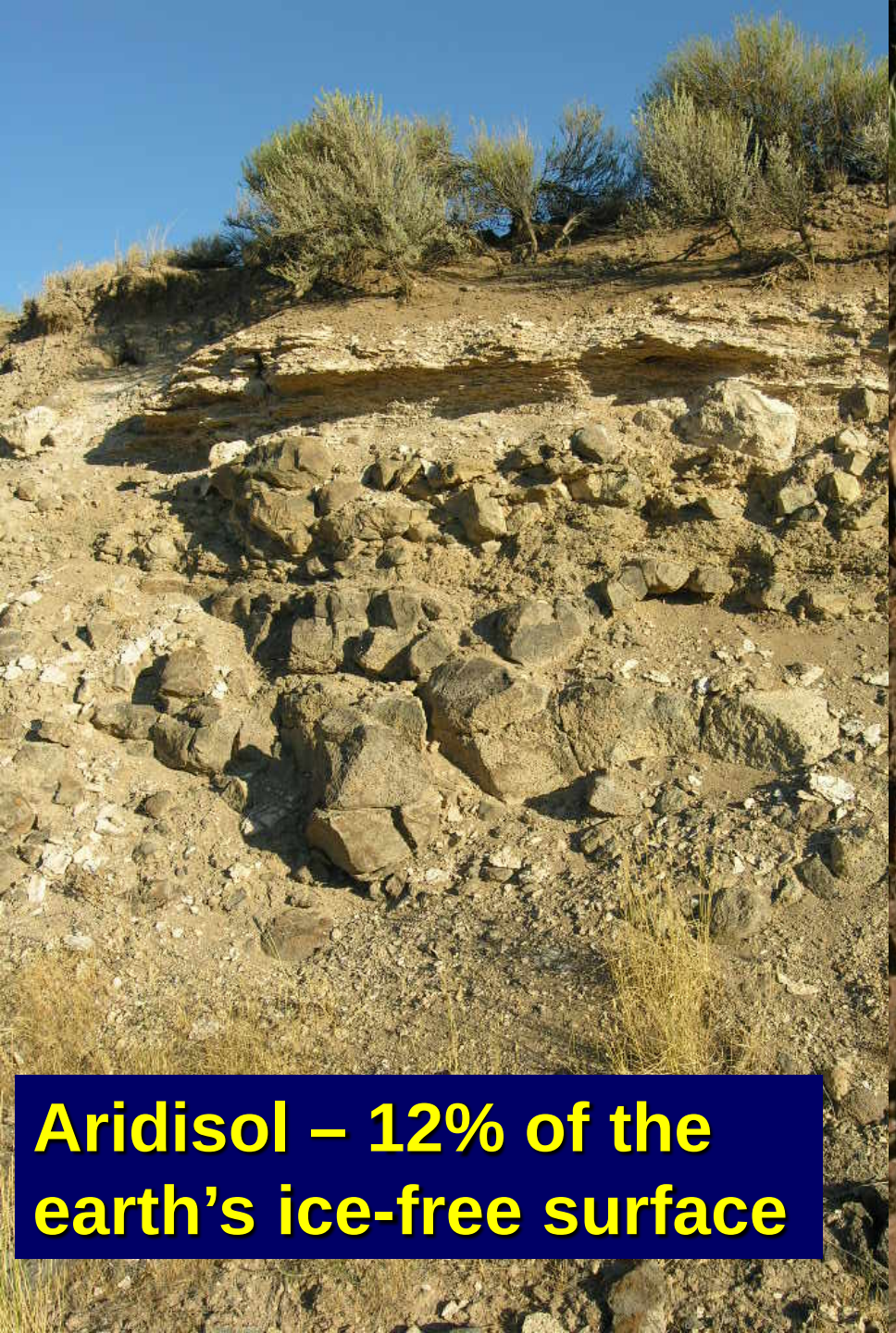
James Cassidy

Soil!

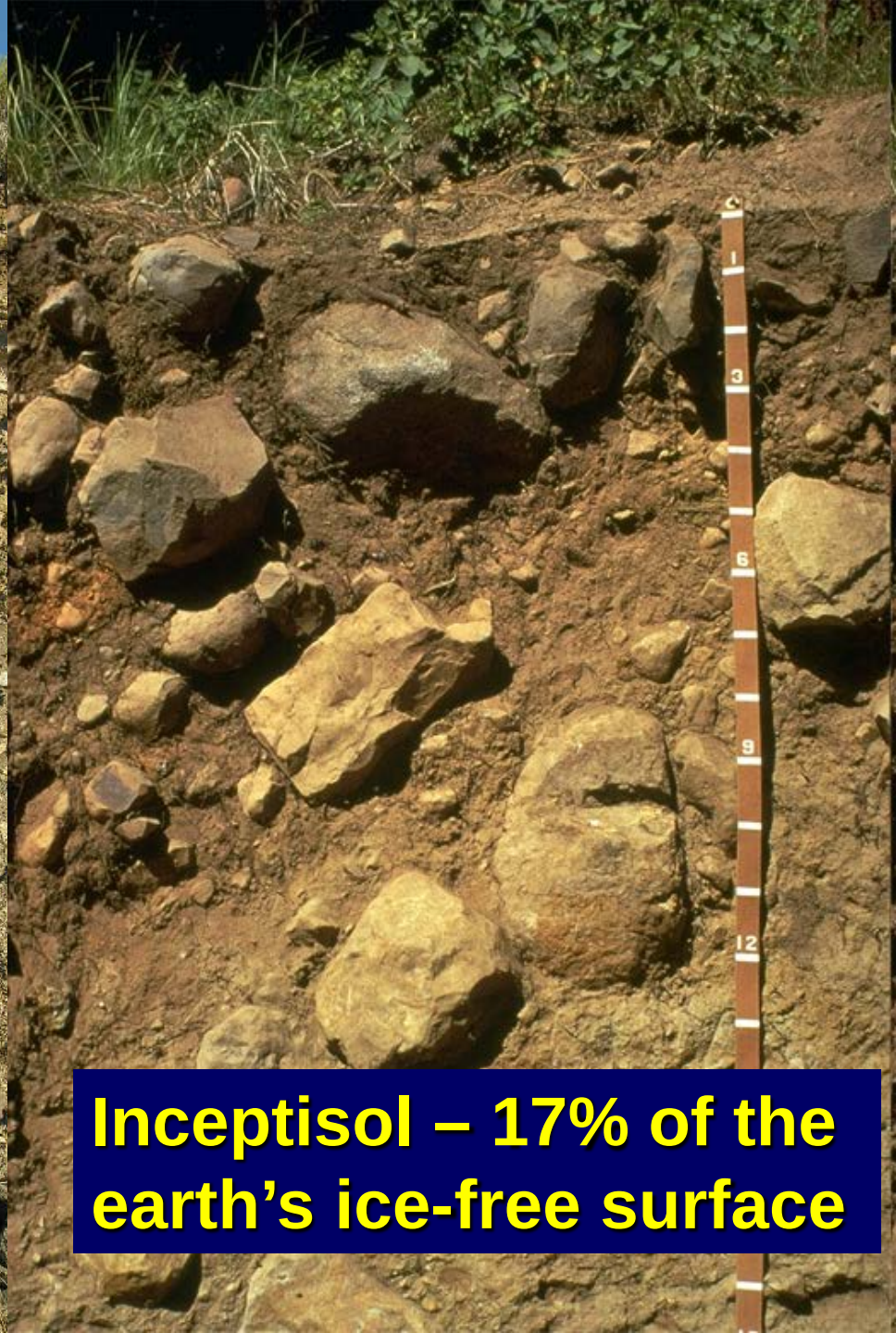
2 of the 12 Soil Orders

Aridisol

Mollisol

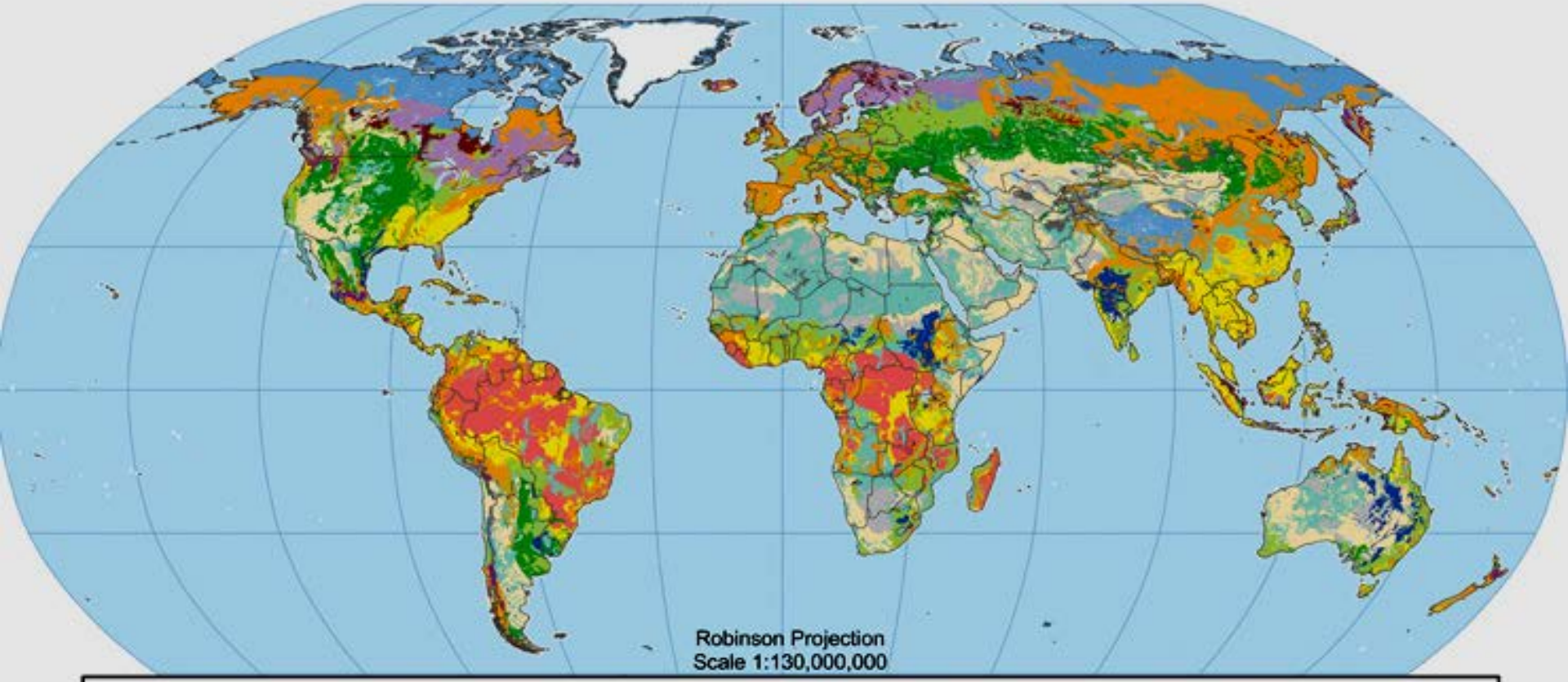


Aridisol – 12% of the earth's ice-free surface



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

Global Soil Regions



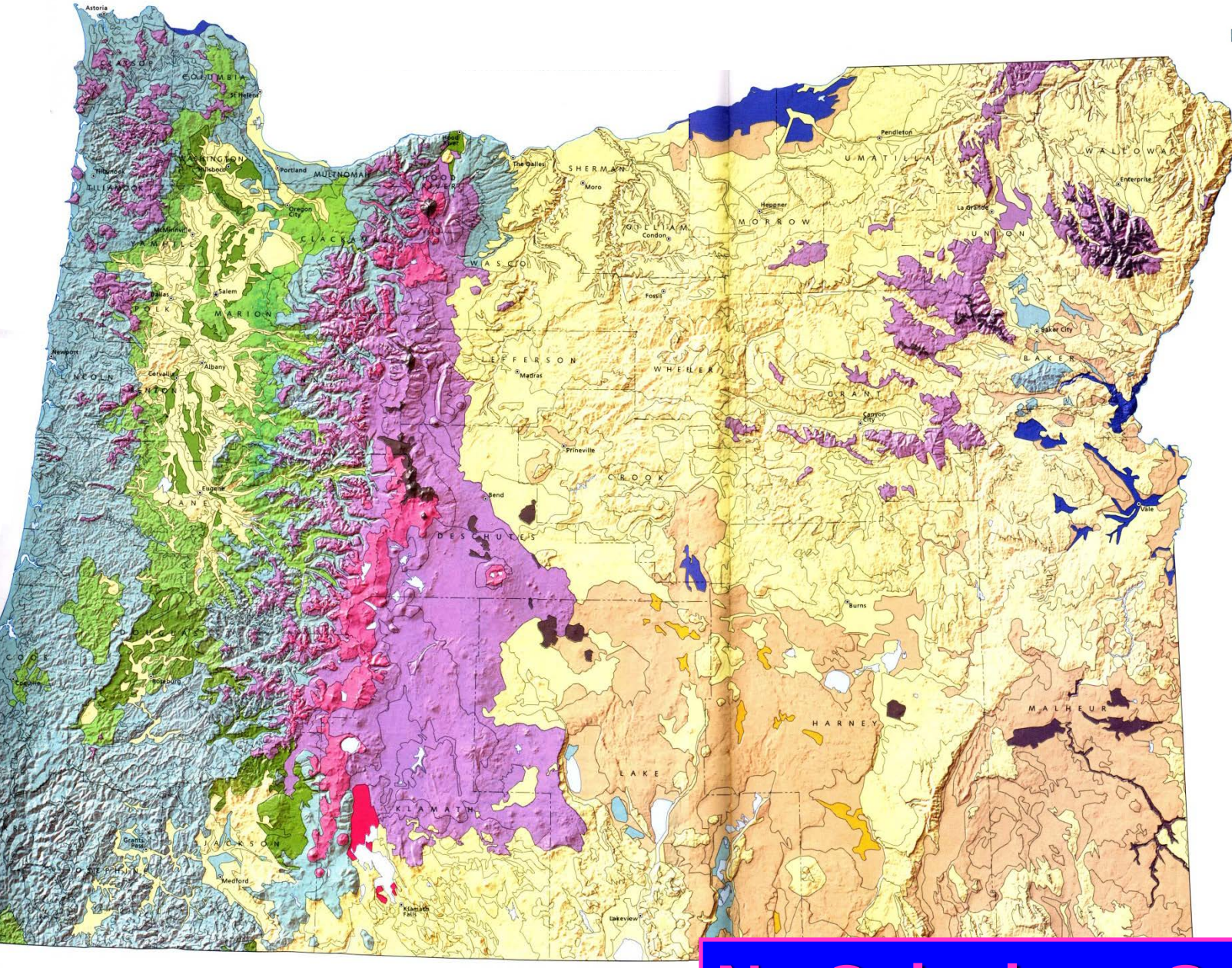
Soil Orders

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

USDA NRCS US Department of Agriculture
Natural Resources
Conservation Service

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

November 2005



Soil Descriptions

Inceptisols

ils that are beginning to form and have weakly developed
il profiles. Inceptisols are most common in the Coast Range,
here they have dark surface horizons (or layers, as when
wed in cross-section) enriched with organic matter and
bsoils in which only brighter colors and better structures
fferentiate the soil from the parent material. Inceptisols in
e Klamath Mountains are similar, but have thinner surface
rizons that are lower in organic matter.

Ultisols

d soils with strongly developed subsoil horizons of clay
cumulation. Oregon Ultisols are mostly paleosols (old soils)
at formed long ago when the climate was warmer and
tter. Ultisols are prominent in the foothills on both sides of
e Willamette Valley and also occur on foothills in Douglas,
sephine and Jackson Counties. They are widely used to
oduce grapes, Christmas trees, grass seed and timber.

Alfisols

ils that have thin surface horizons enriched with organic
atter and subsoil horizons of clay accumulation. Alfisols
cur mainly in Western and southern Oregon. Typical examples
clude the reddish brown Willakenzie soils in the foothills of
e Willamette Valley and the reddish brown Abegg and Ruch
ils on old terraces in Jackson County.

Andisols

ils developed in materials of volcanic origin. Coast Range
ndisols are black, light-weight soils developed from basalt
der cool, humid conditions. Cascade Range Andisols develop
m mixed ash and weathered andesite. Andisols from Crater
ke northeastward to Newberry Crater are developed mainly
m pumice. Andisols in northeastern Oregon are formed in
blanket of white ash mainly from the eruption of Mount
azama.

Spodosols

ils with white near-surface horizons over iron-rich subsoils
rmed in sandy materials under pine or spruce in cool, humid
eas. Spodosols are the dominant soil at high elevations along
e crest of the Cascades, but they are also prominent
mponents of the landscape along the Coast from Newport
Brookings. Many coastal Spodosols in Coos and Curry
unties are intensively used for cranberry production.

Histosols

ighly organic soils, composed almost entirely of the decayed
mains of plants that grew in marshy environments. Histosols
e dominant only in the vicinity of Upper Klamath Lake, but
ey are perhaps better known in the small, finger-like areas
Lake Labish just north of Salem, where the Semiahmoo
ries is used intensively to produce Spanish onions.

Aridisols

ils found in the driest parts of southeastern Oregon, mainly
old playas and lake basins and on surrounding uplands in
ke, Harney and Malheur Counties. Surface horizons for
ese soils are light in color and low in organic matter. Many
ridisols have subsoil horizons enriched with clay. Some have
ccumulations of free lime in the subsoil. A few, where the
asonal water table is close to the surface, are salty. Many
ridisols are underlain at shallow depth by either volcanic
edrock or by a soil-formed hardpan.

Mollisols

ils formed mainly in association with grassland vegetation.
ollisols have relatively thick, dark surface horizons rich in
rganic matter under which are subsoils that are either weakly
eveloped or enriched in clay or carbonates. More than 650
regon soil series are Mollisols—this order occupies the largest
rea of any soil order in the state. On the main floor of the
illamette Valley they are deep, dark, fertile soils. In Eastern
regon they have lower amounts of organic matter and are
ore likely to be associated with carbonate accumulations,
ardpans, or shallow bedrock.

Vertisols

lay soils that shrink and swell appreciably upon wetting and
rying. Vertisols are dominant soils only in small areas of south-
entral Oregon, but they form important components of the
oil landscape on low foothills and in tributary valleys of the
Villamette Valley (Bashaw series), Douglas County (Curtin
eries) and Jackson County (Carney and Coker series).

Entisols

oils found mainly in recently deposited parent materials that
re too young to have developed soil horizons. The largest
rea dominated by Entisols is the Columbia Basin in Morrow
nd Umatilla Counties. Irrigation with Columbia River water
as made these sandy soils agriculturally productive. Other
ntisols occur in small areas on floodplains of rivers and
treams, where frequent flooding continually adds new
ediments to the land surface.

Rock **Water**

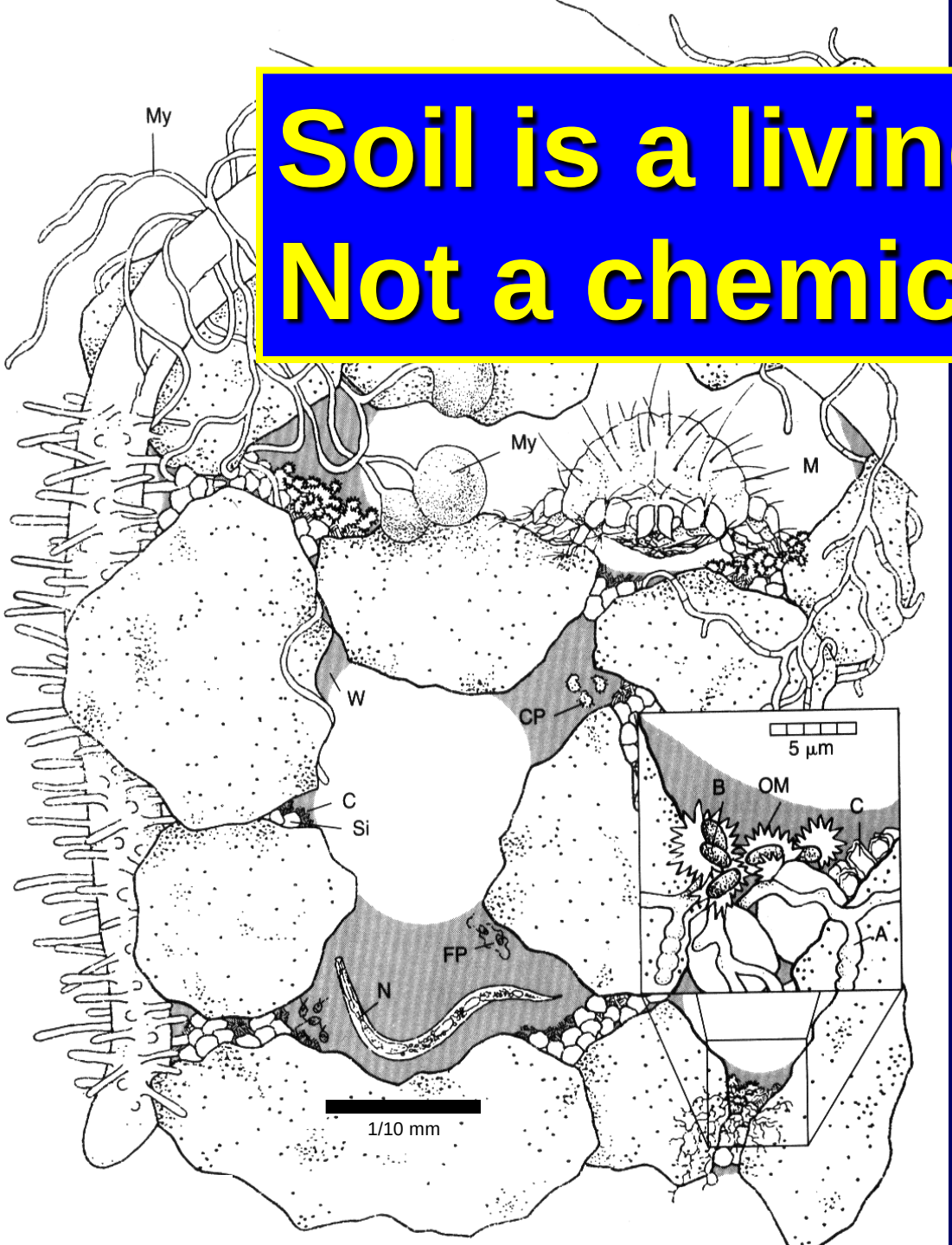
ote: Gray lines within soil orders are boundaries of suborders shown
n the following two pages.

No Oxisols or Gelisols!


Spodosol
Oregon Coast


Soil is habitat!

Soil is a living thing!
Not a chemical sponge!



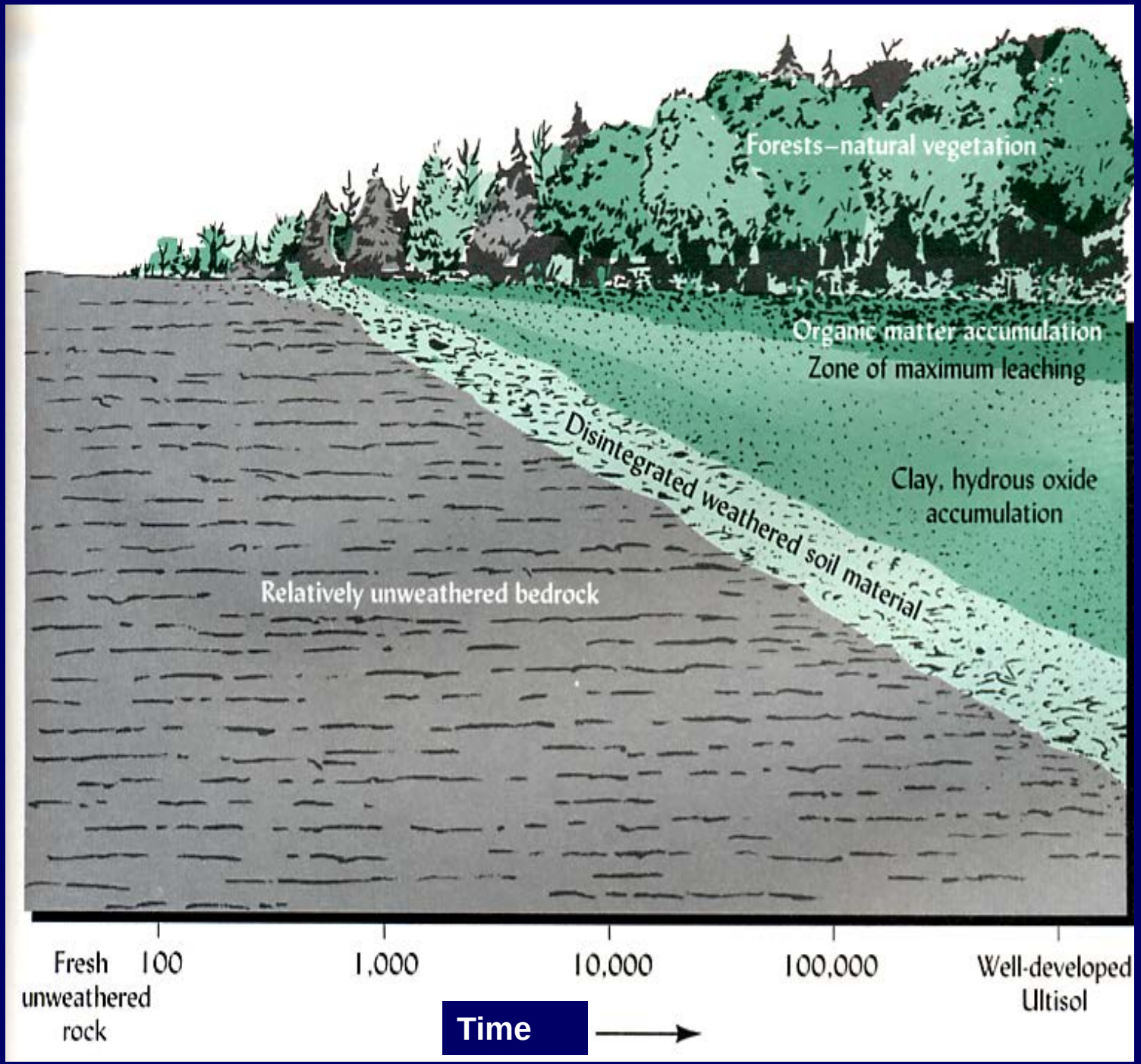
B – Bacteria
A – Actinomycetes
My – Mycorrhizae
H – Saprophitic fungus
N – Nematode
CP – Ciliate protozoa
FP – Flagellate protozoa
M – Mite

< 1mm

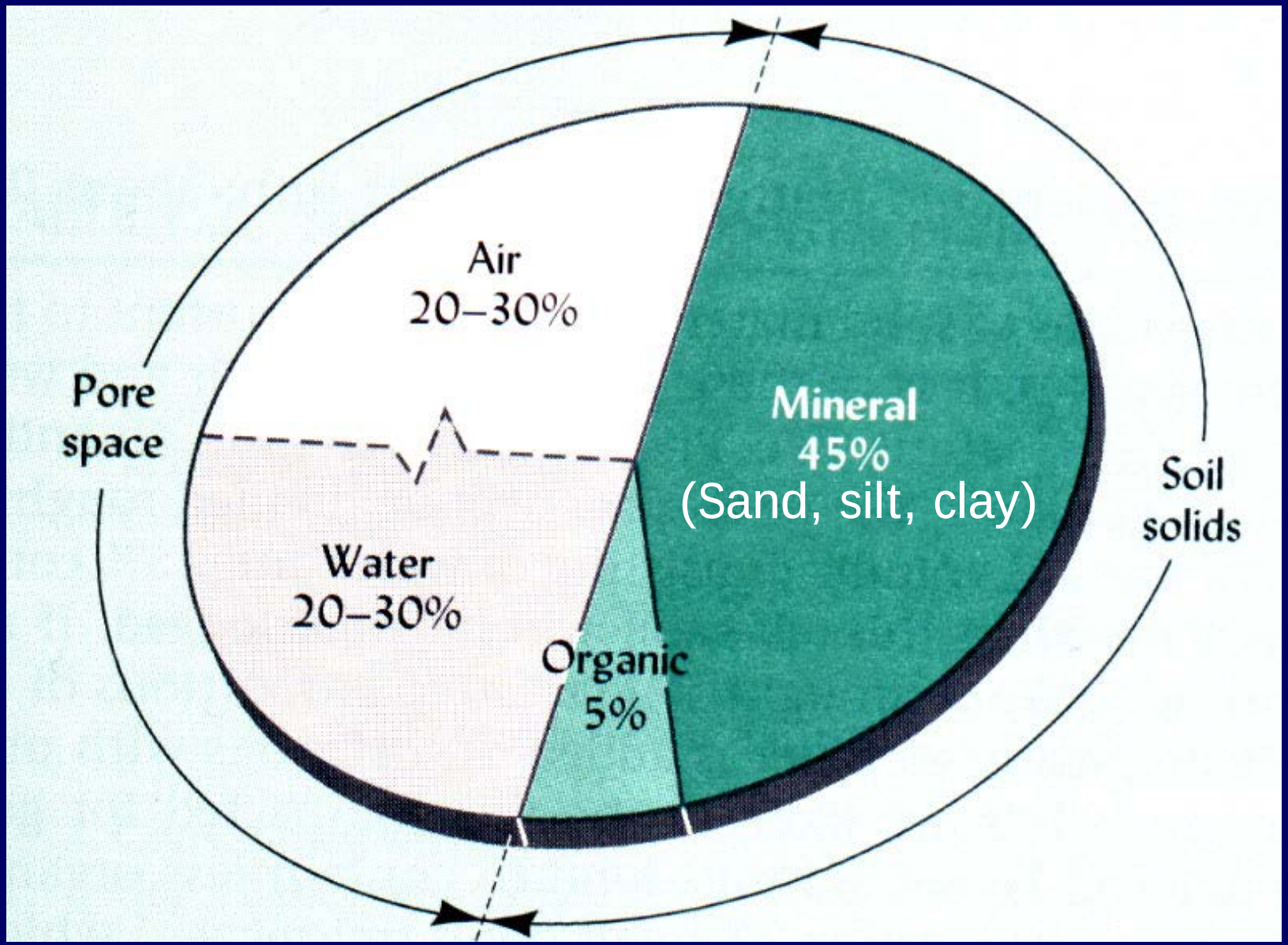
What is Soil?

Soil is:

- "Rotted" Rock
- Decomposed Organic Matter


Forests–natural vegetation
Organic matter accumulation
Zone of maximum leaching
Disintegrated weathered soil material
Clay, hydrous oxide accumulation
Relatively unweathered bedrock
Fresh unweathered rock
100
1,000
10,000
100,000
Well-developed Ultisol
Time

The four components of soil:

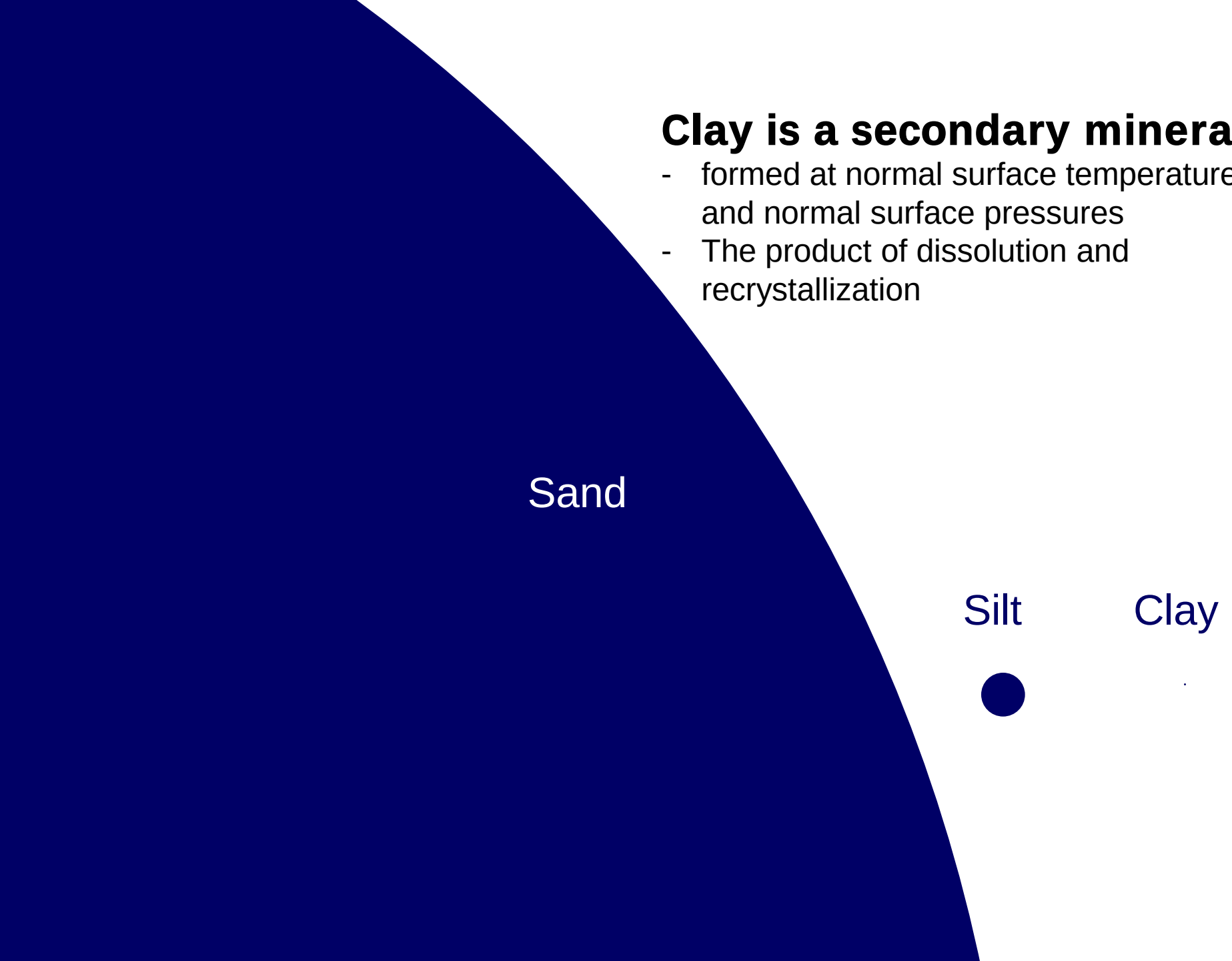


Rock – primary mineral

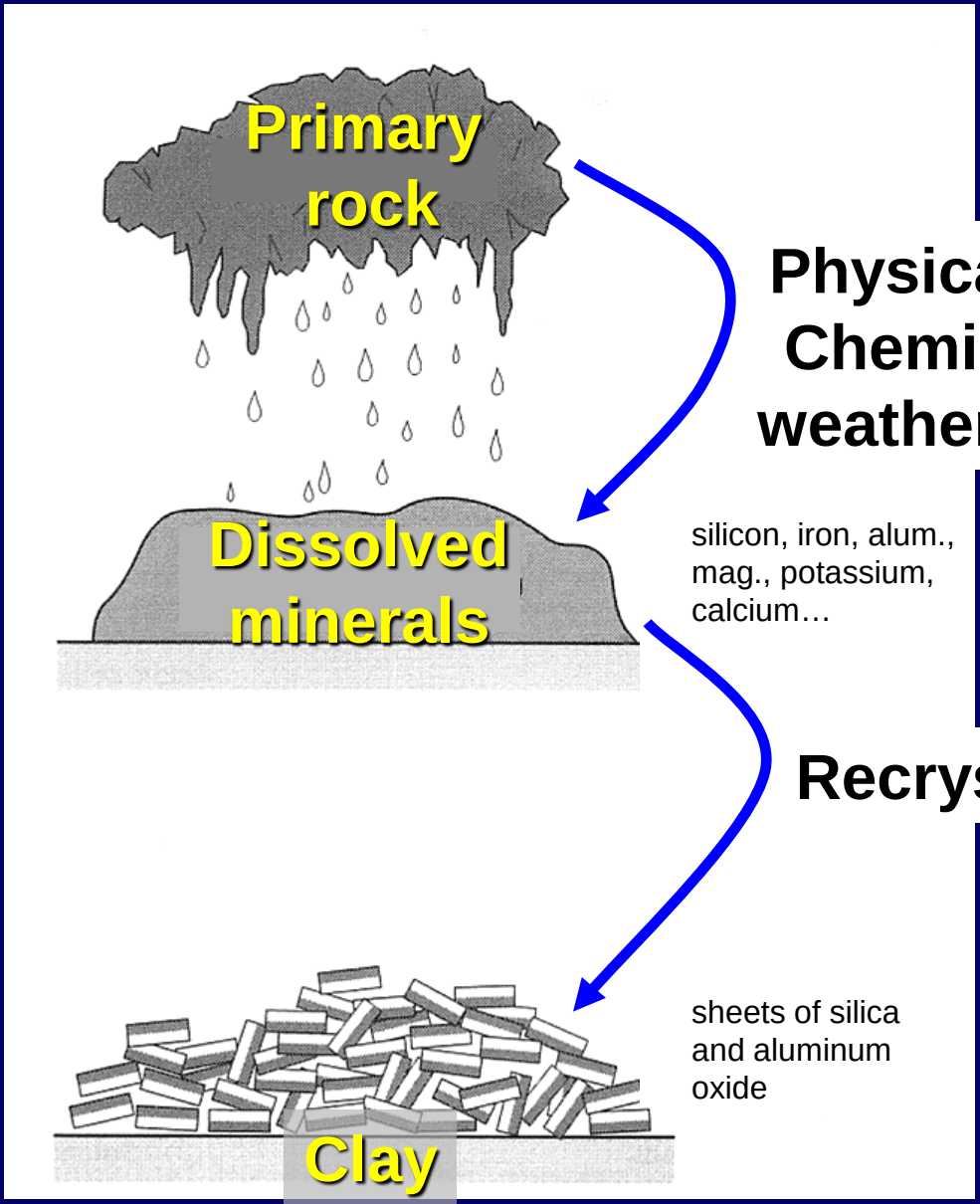
Granite

Clay is a secondary mineral

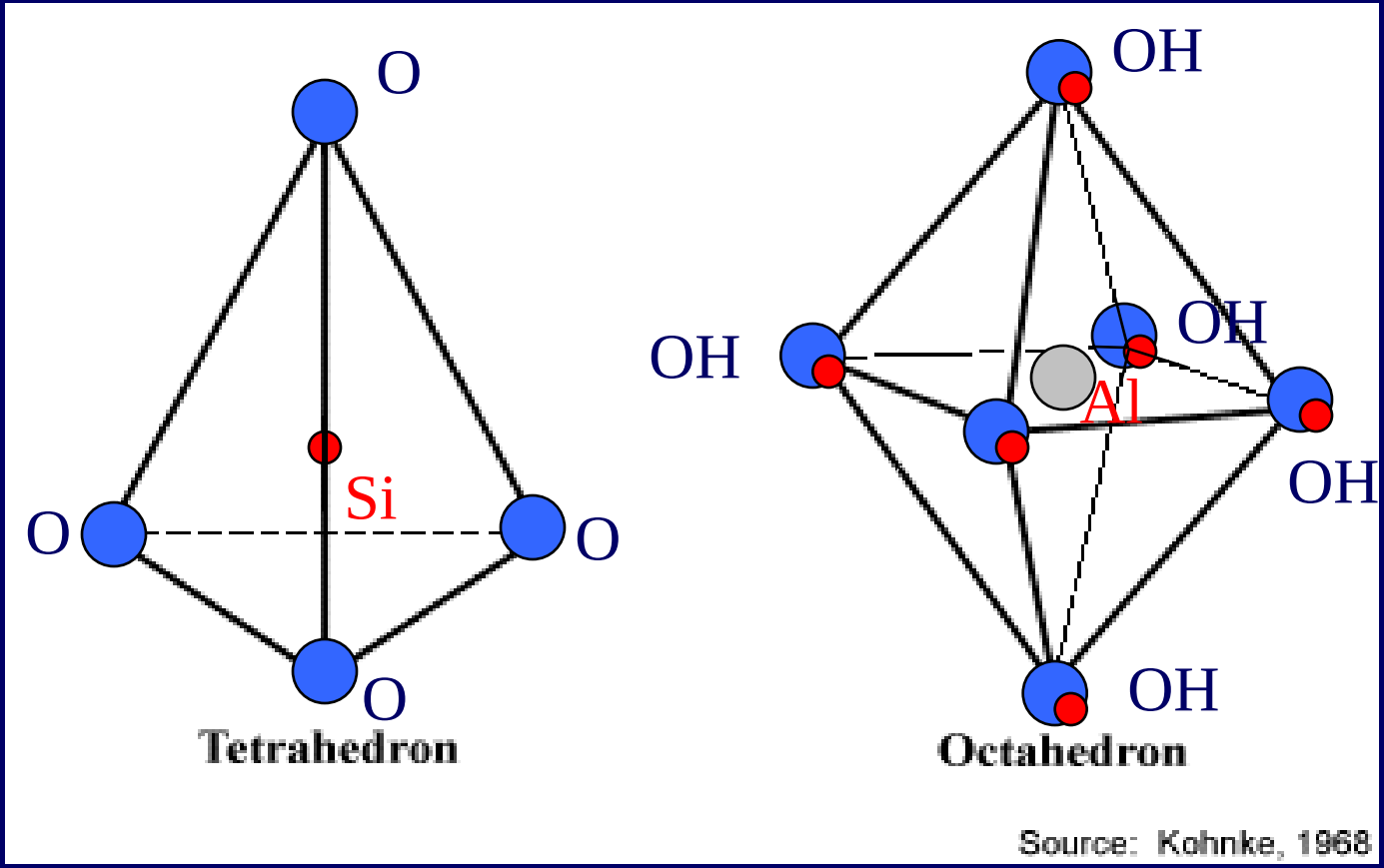
- formed at normal surface temperatures and normal surface pressures
- The product of dissolution and recrystallization



Rocks dissolve and recrystallize



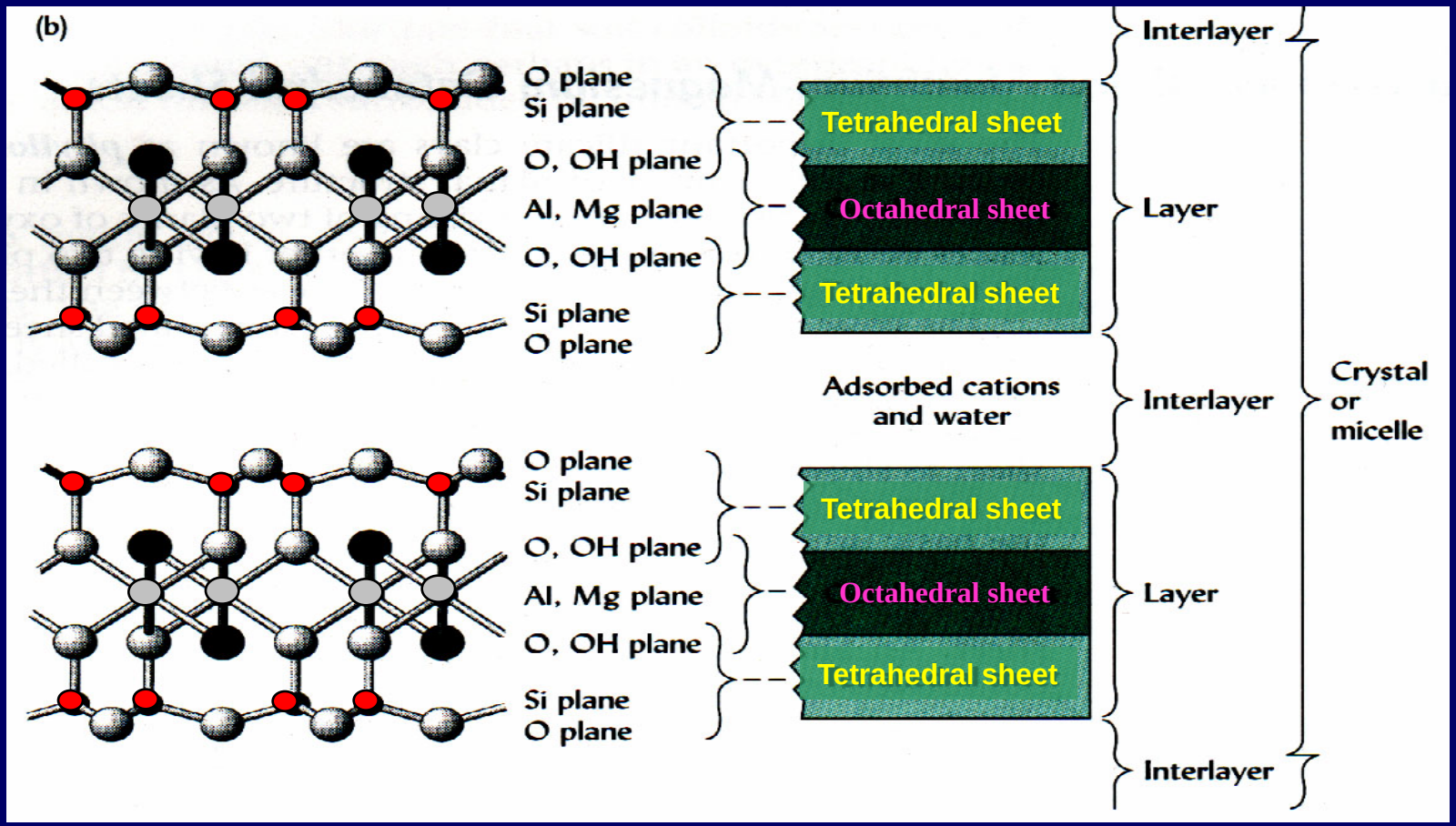
When rocks dissolve…



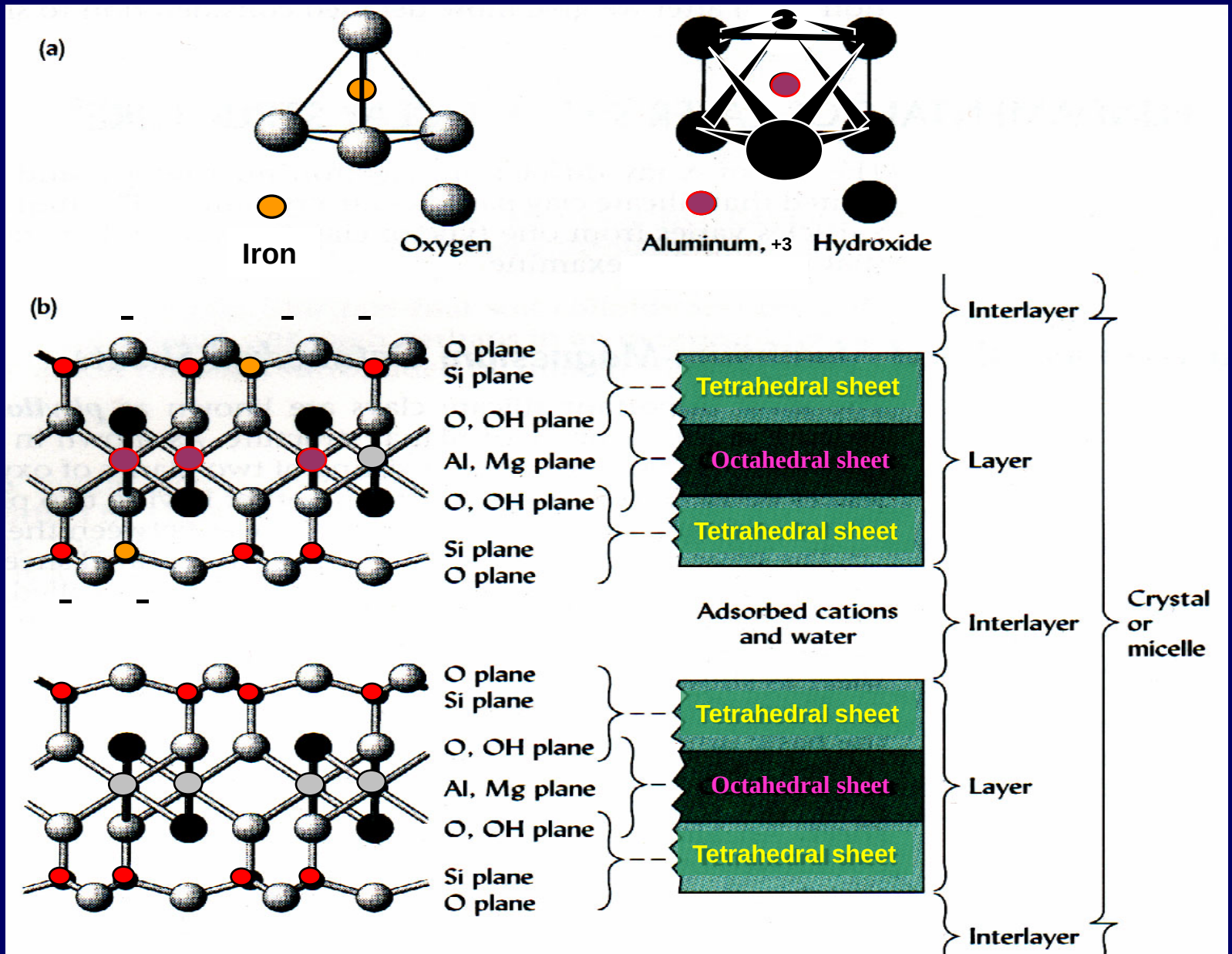
Tetrahedron - a 3D geometric form contained by four plane faces; a triangular pyramid.

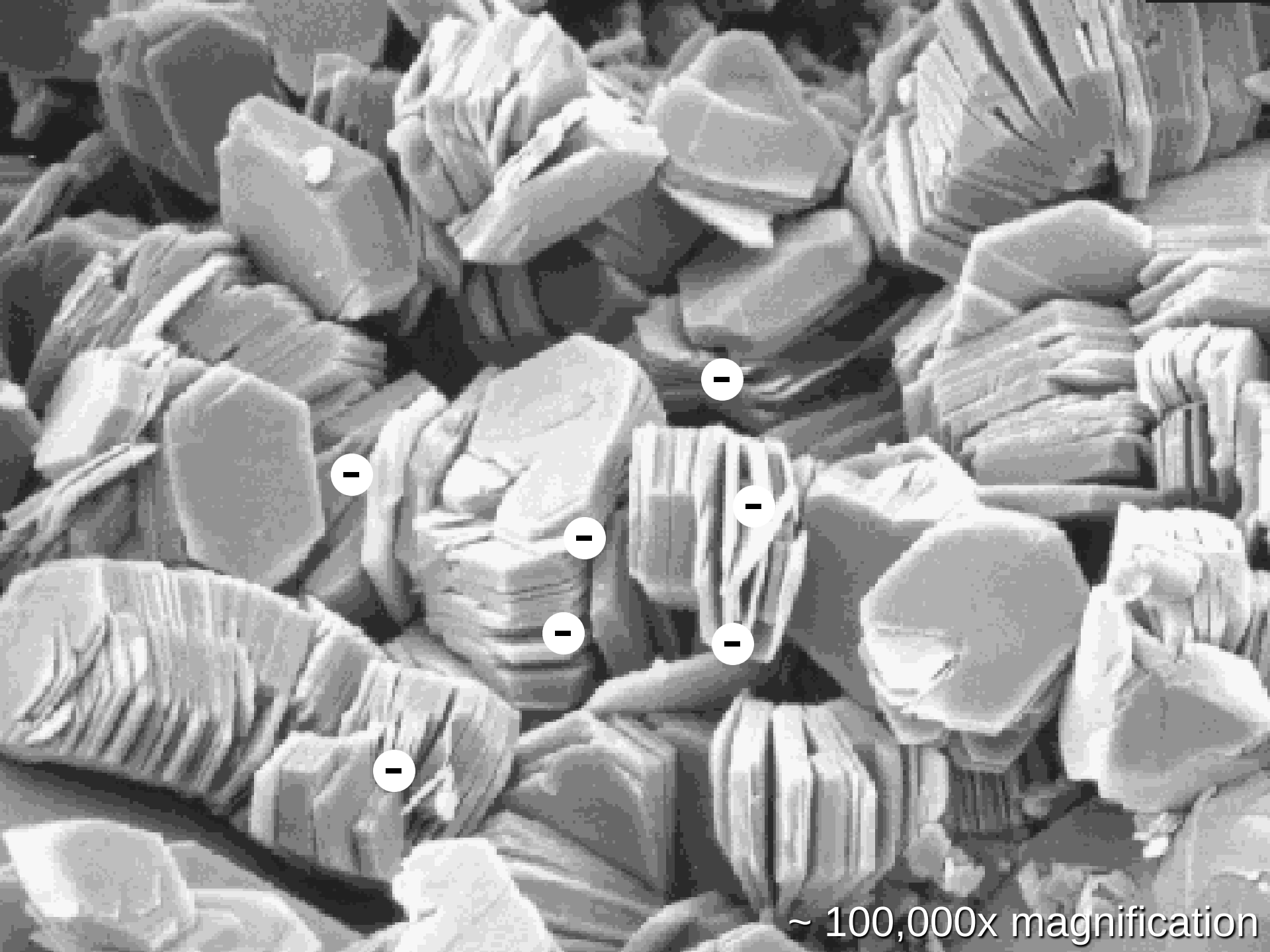
Octahedron - a 3D geometric form contained by eight plane faces.

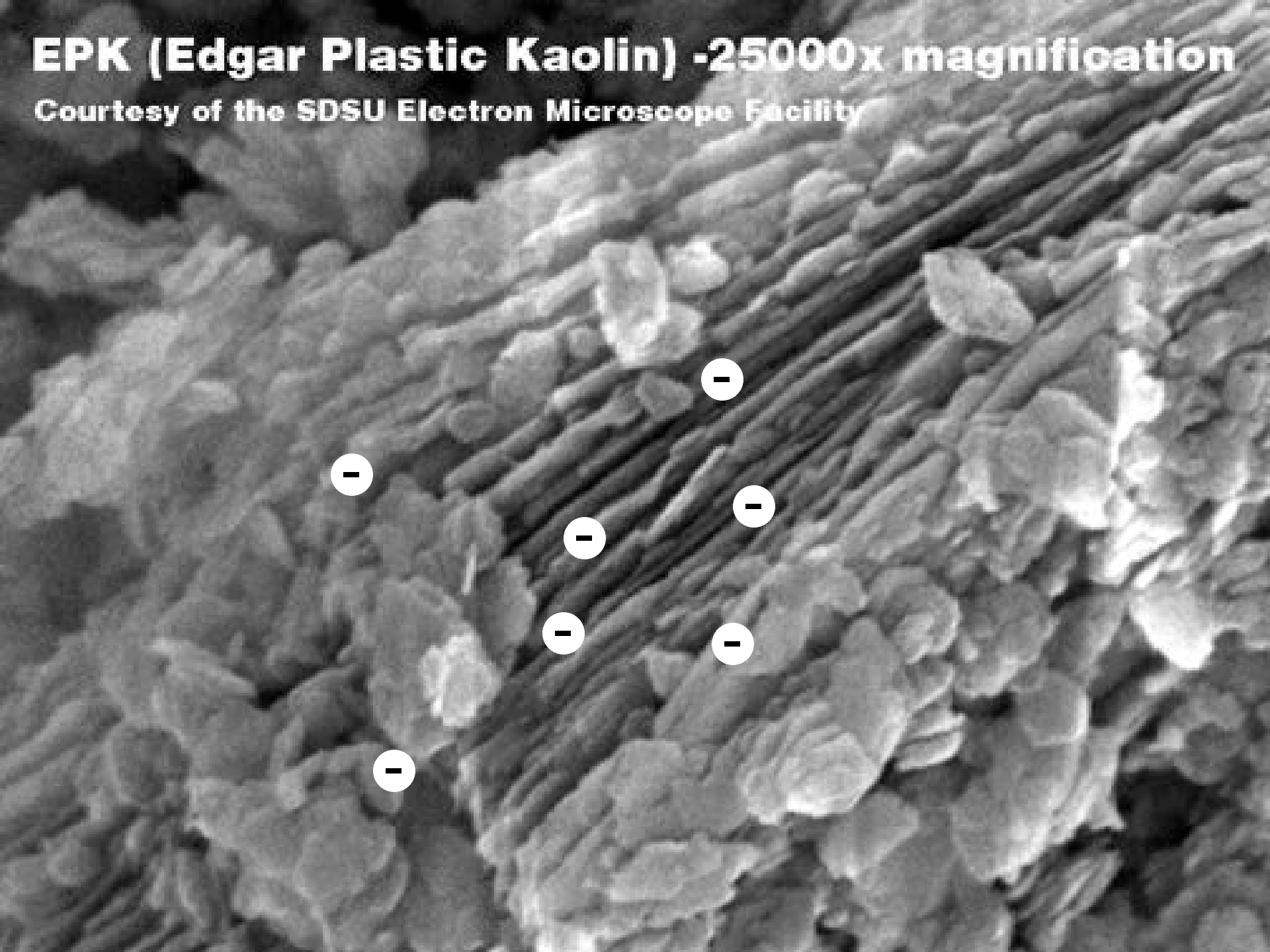
...and recrystallize.
Clay – secondary mineral



Isomorphic Substitution… one source of charge in soils



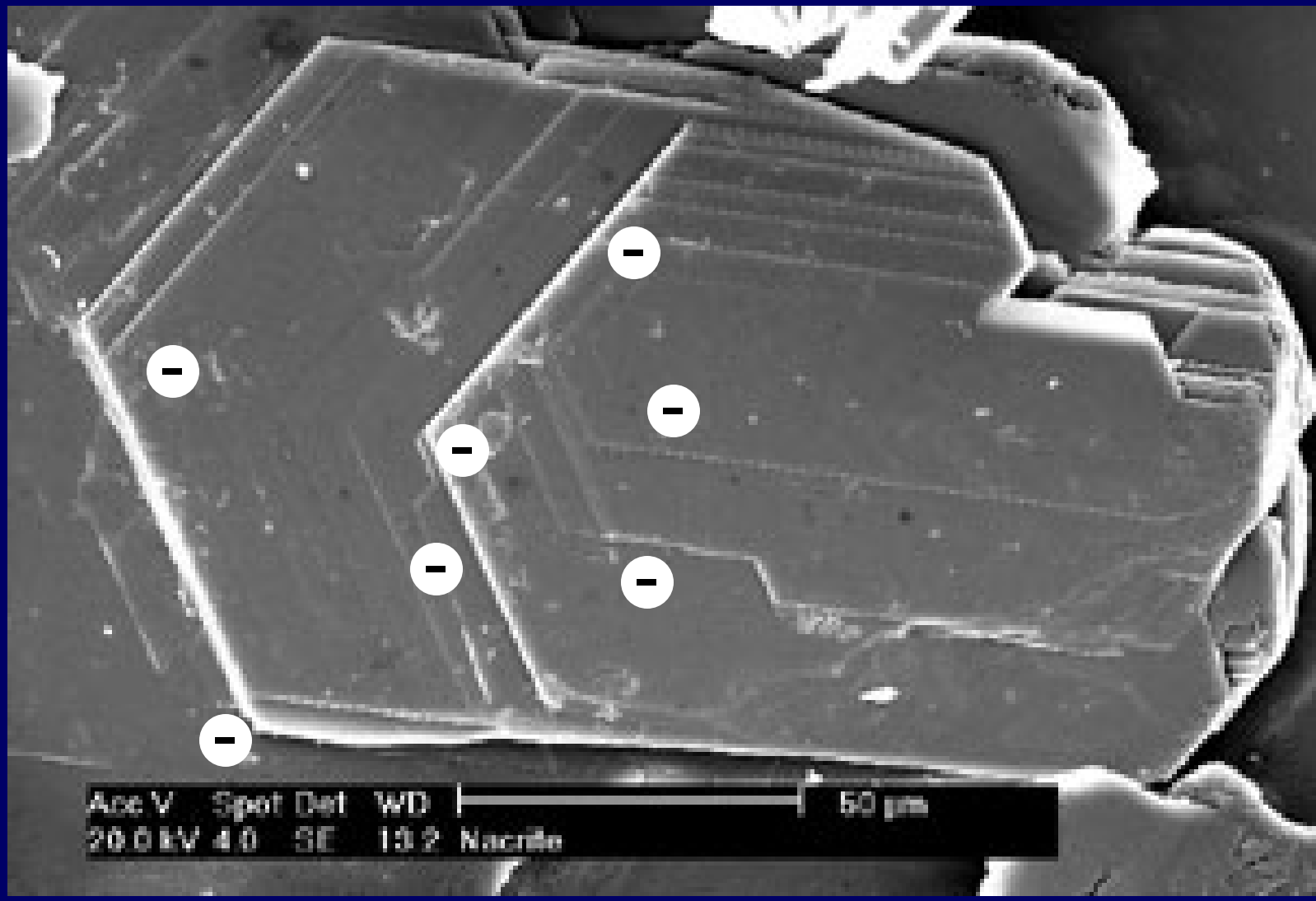

~ 100,000x magnification


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, Lodève Basin, France

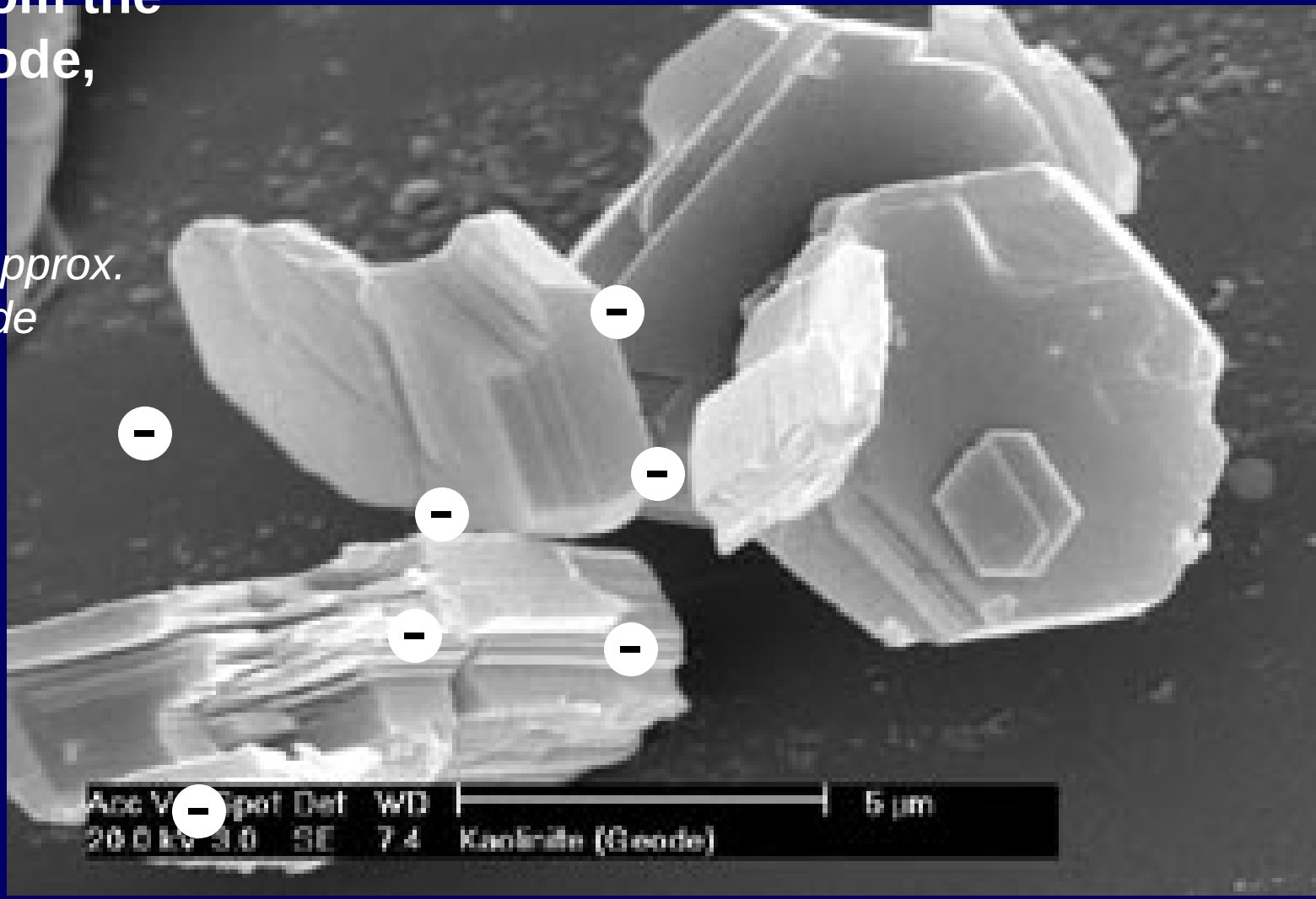
Field of view approx. 200 microns wide

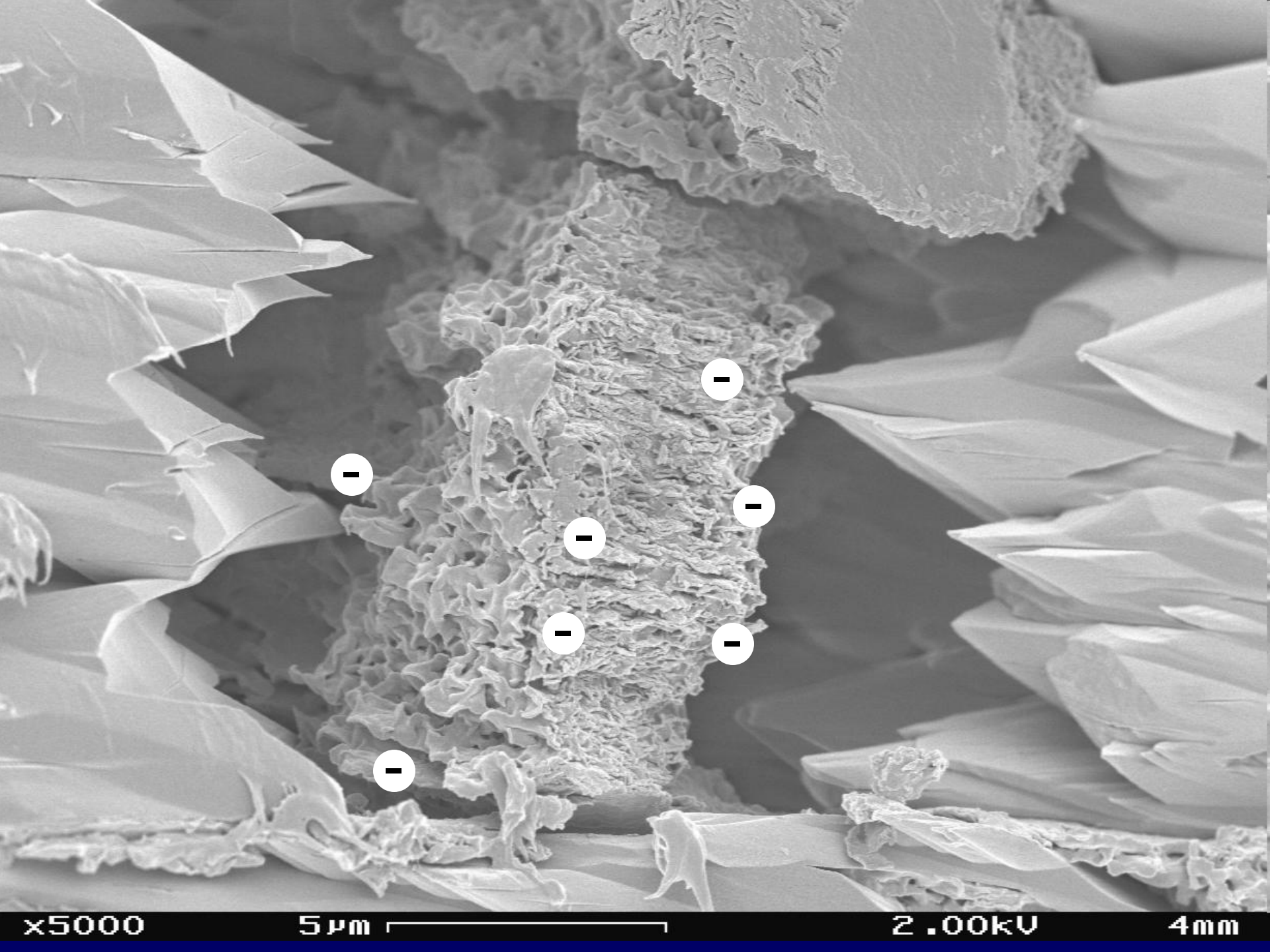


Kaolinite

Well crystallized kaolinite from the Keokuk geode, USA

Field of view approx. 18 microns wide




x5000
5µm
2.00kV
4mm

Clay

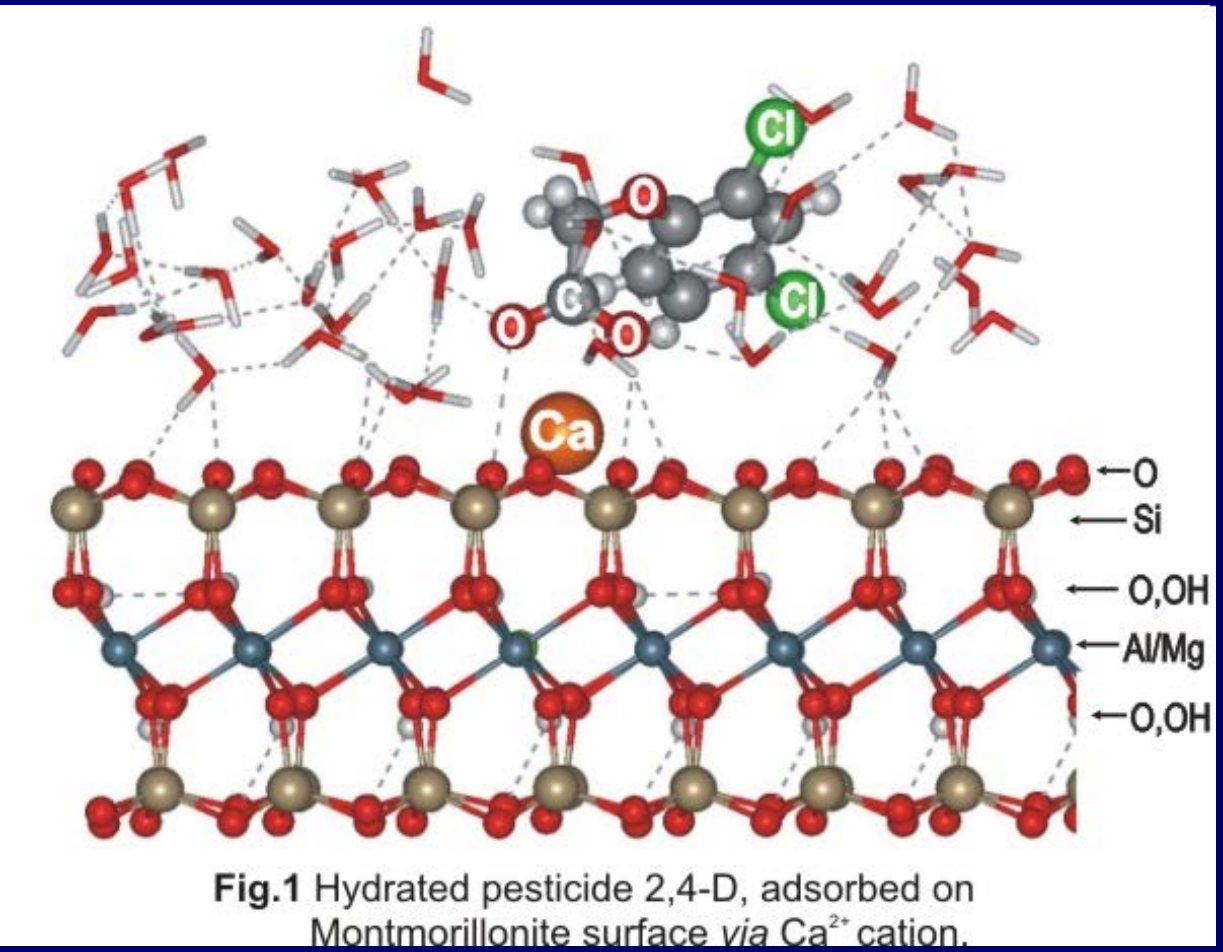
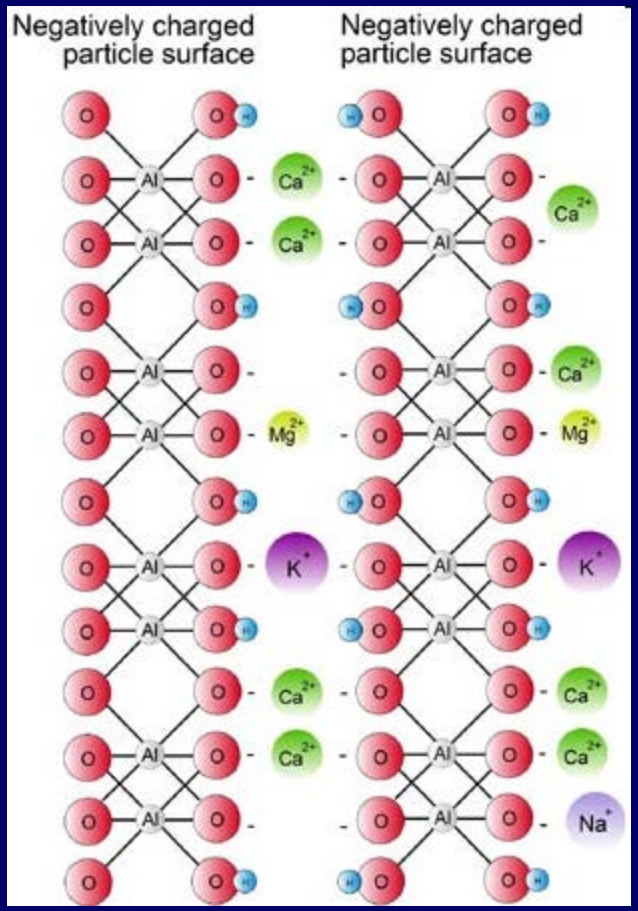


Fig.1 Hydrated pesticide 2,4-D, adsorbed on Montmorillonite surface *via* Ca^{2+} cation.



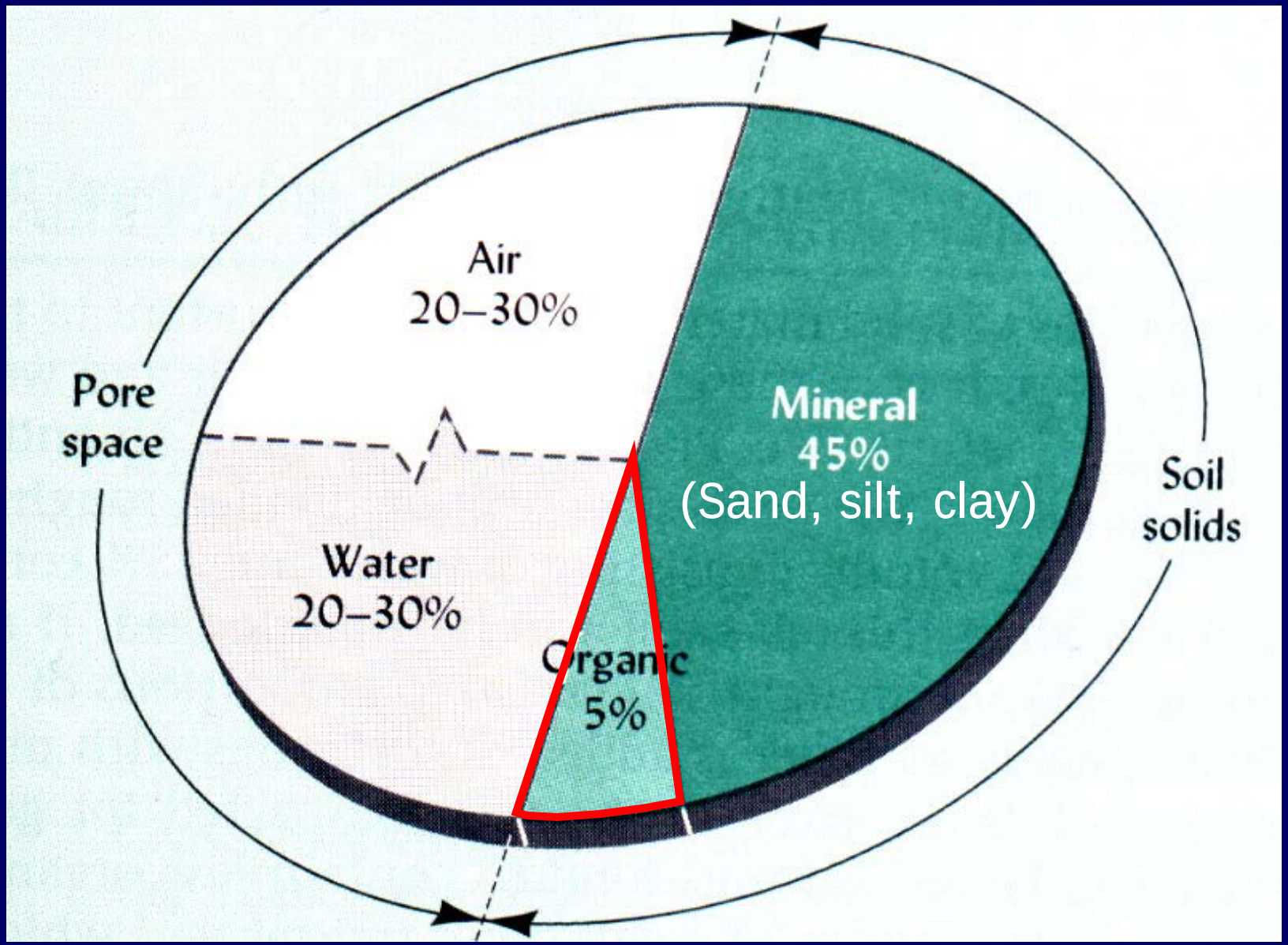
http://virtual-museum.soils.wisc.edu/soil_smectite/index.htm

What is Soil?

Soil is:

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

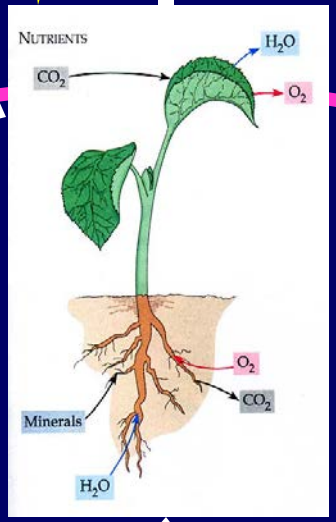
What is Organic Matter?



Sun

air

water



Decomposers

Consumers

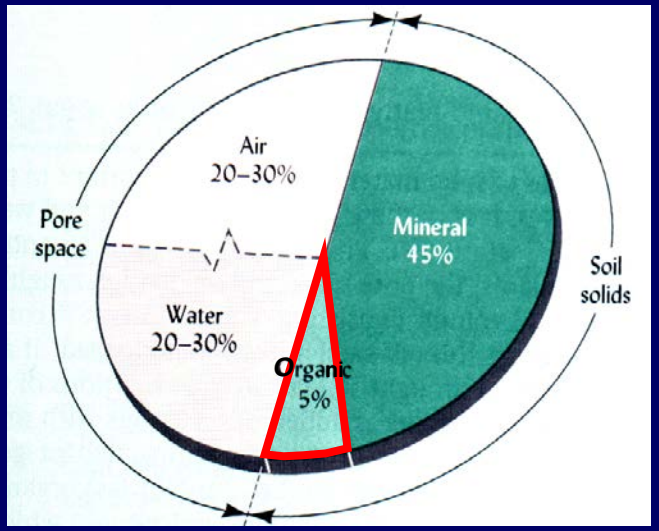
soil

Humus (Organic Matter!)

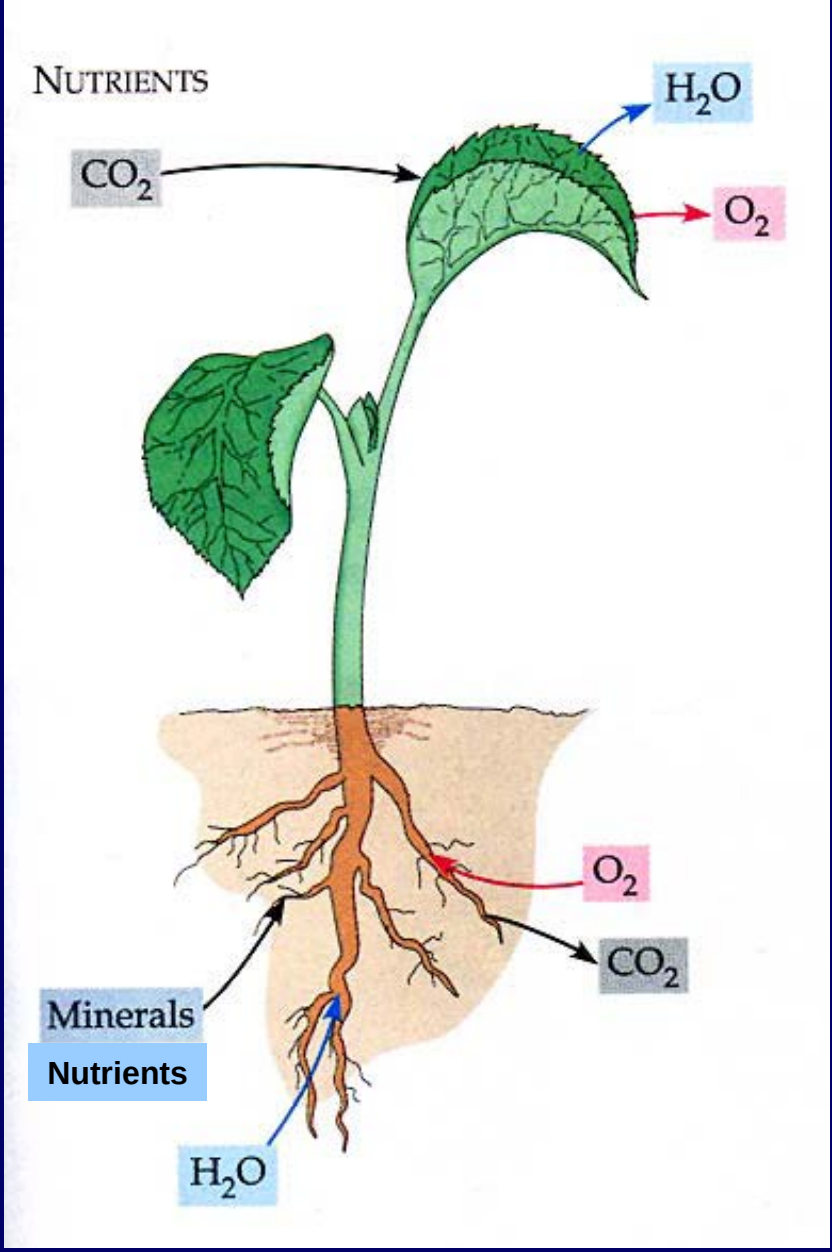
Functions of Organic Matter

Organic Matter

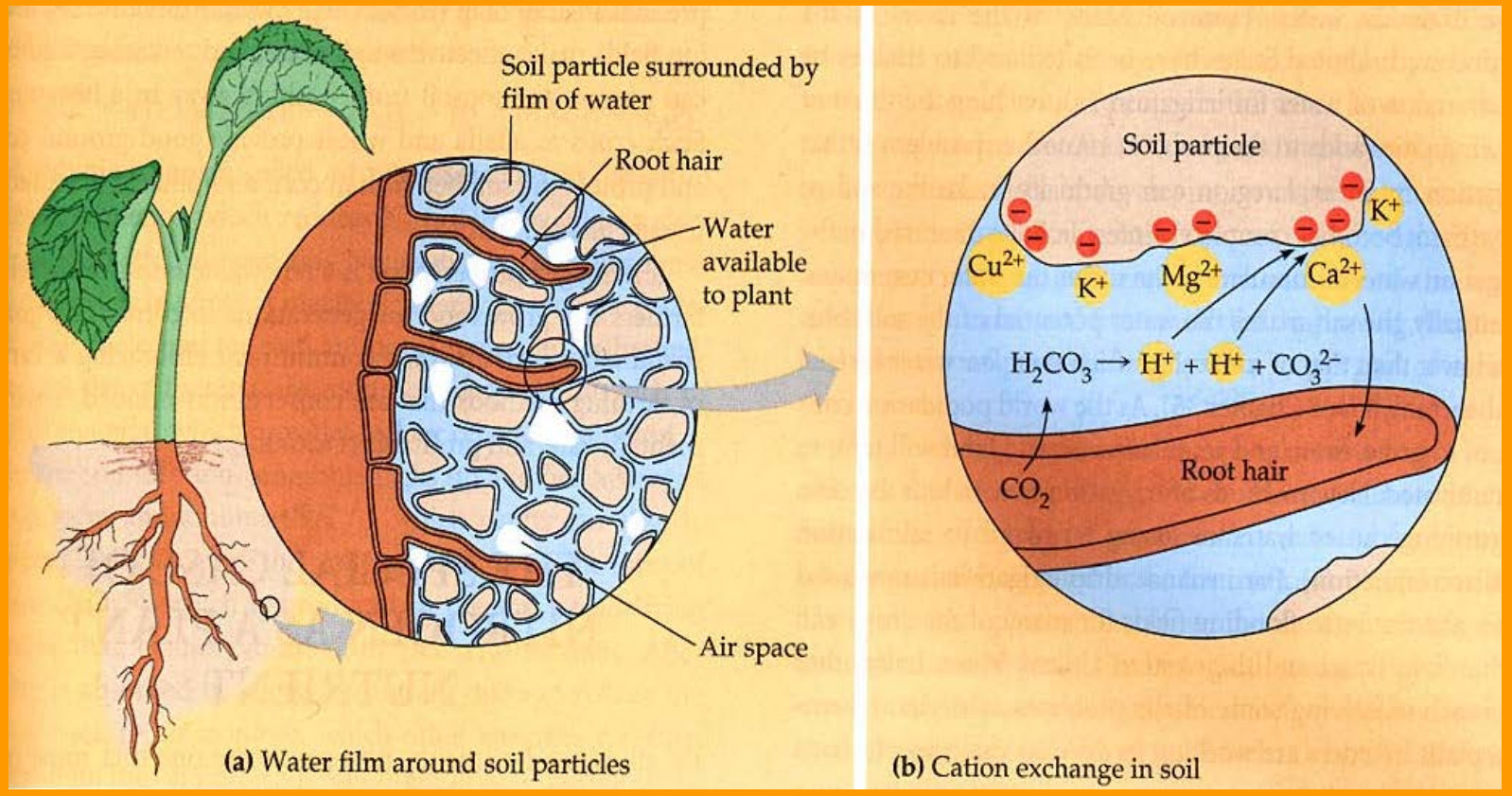
…provides another source of charge in soils – twice that of clay!

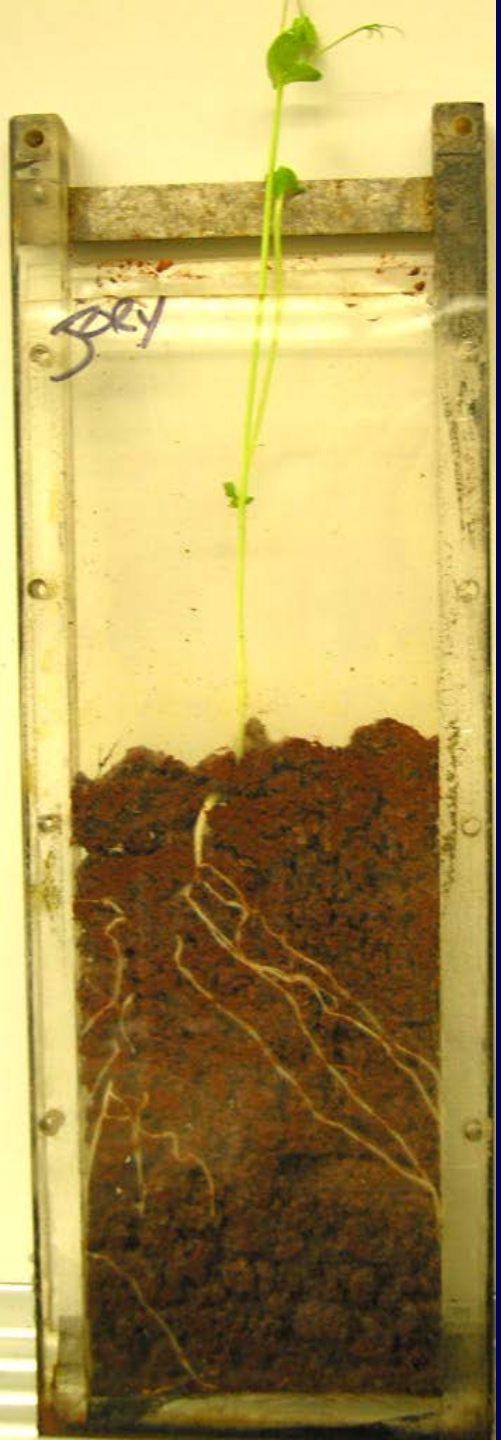


How a plant works



How a plant works



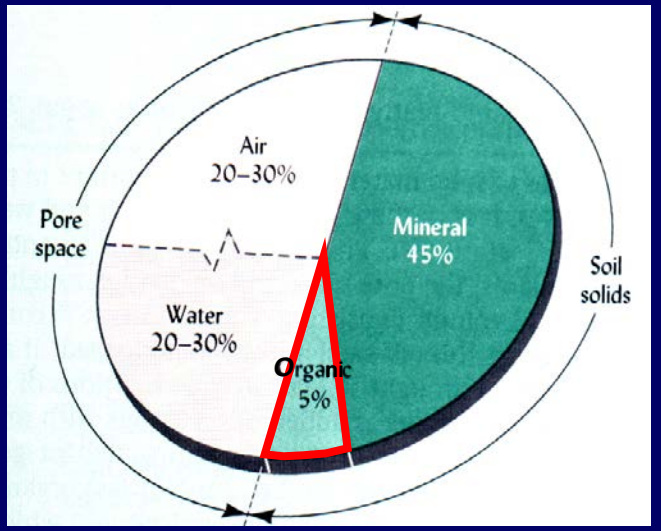


Functions of Organic Matter

1. **Carbon and energy** - for soil organisms

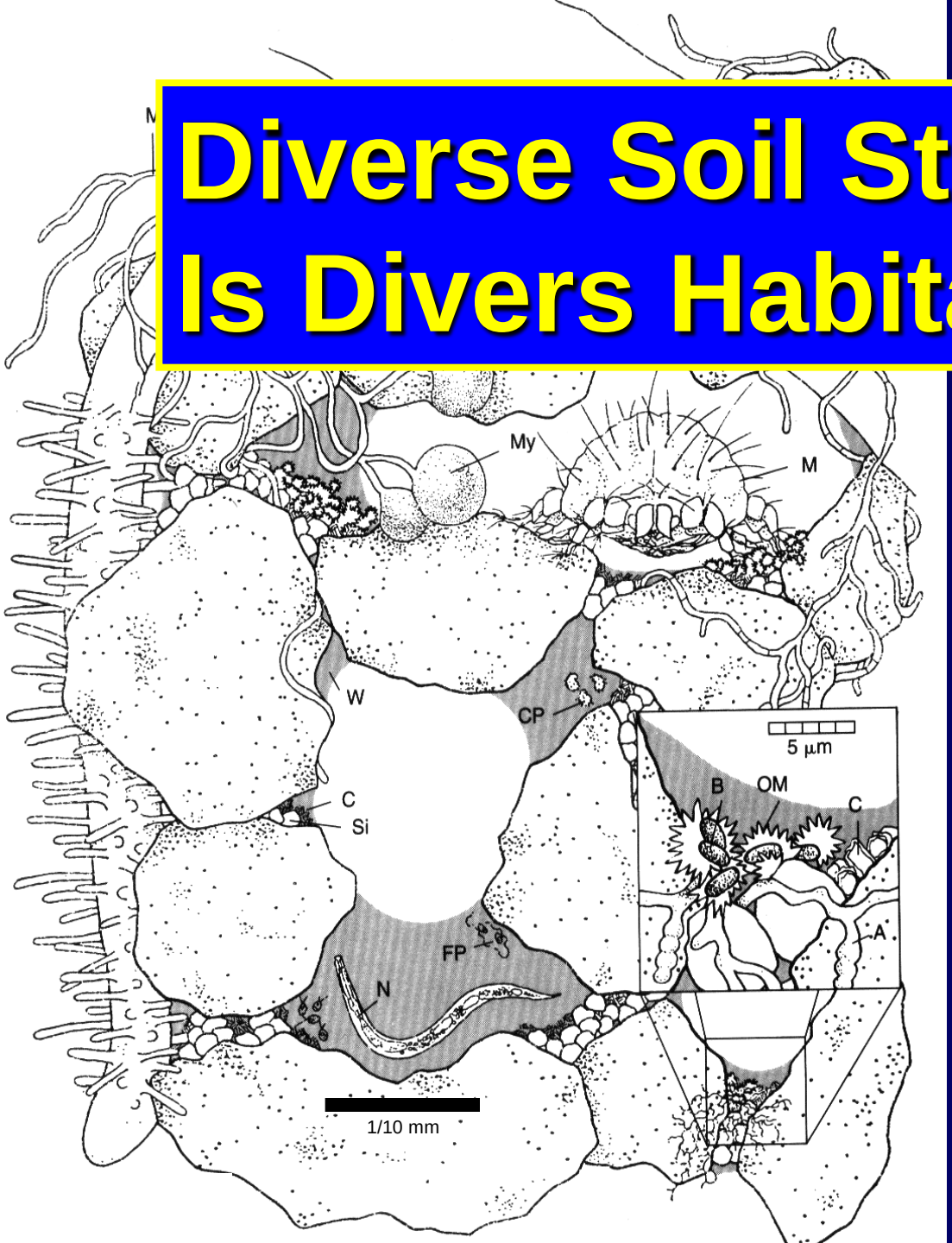
2. **Provides nutrient storage!** – negative charge – twice that of clay!

3. **Structure** - Stabilizes soil structure, making soil easily managed – **SOIL GLUE!**



Soil “structure”

Diverse Soil Structure Is Divers Habitat!



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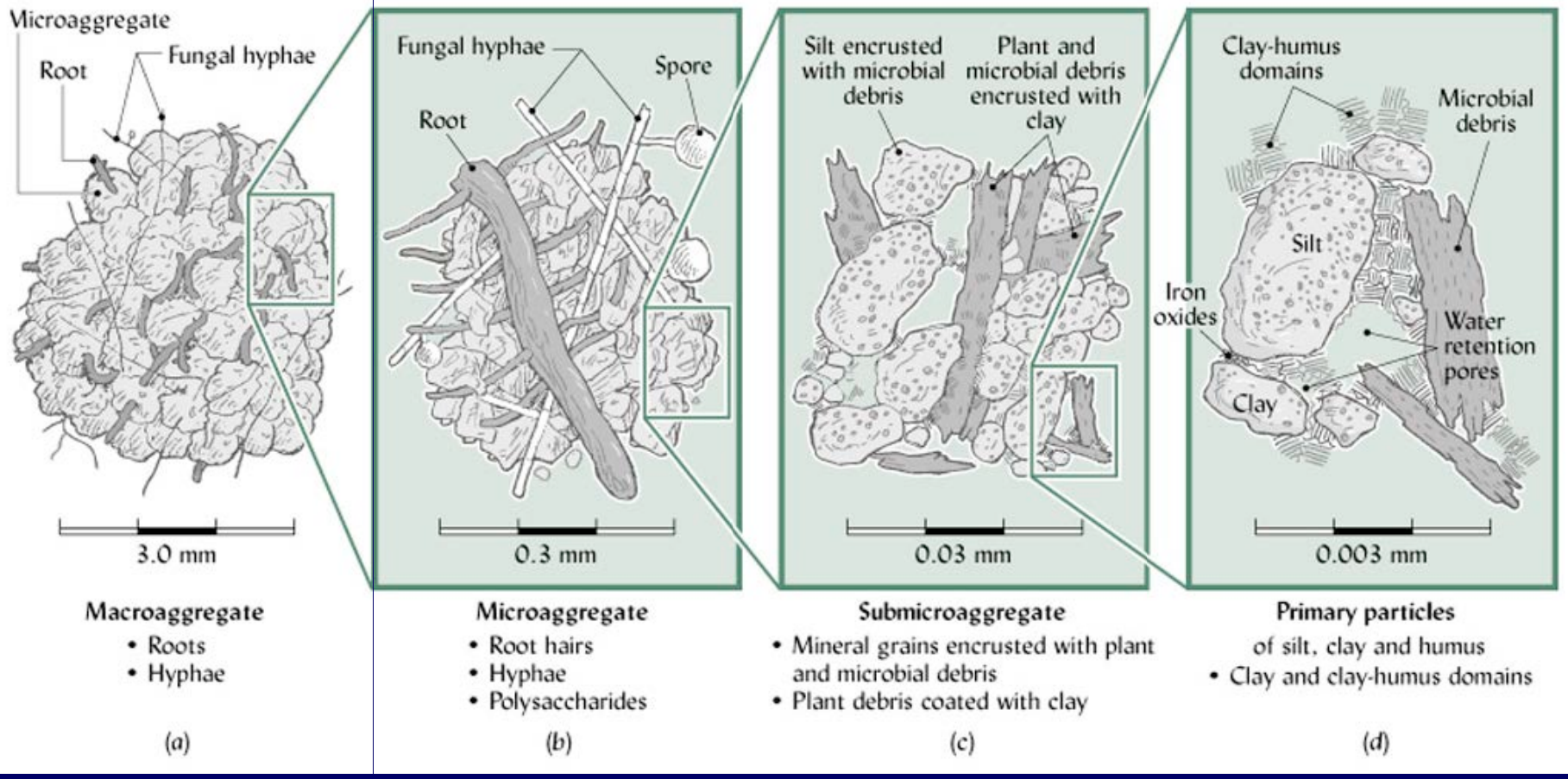
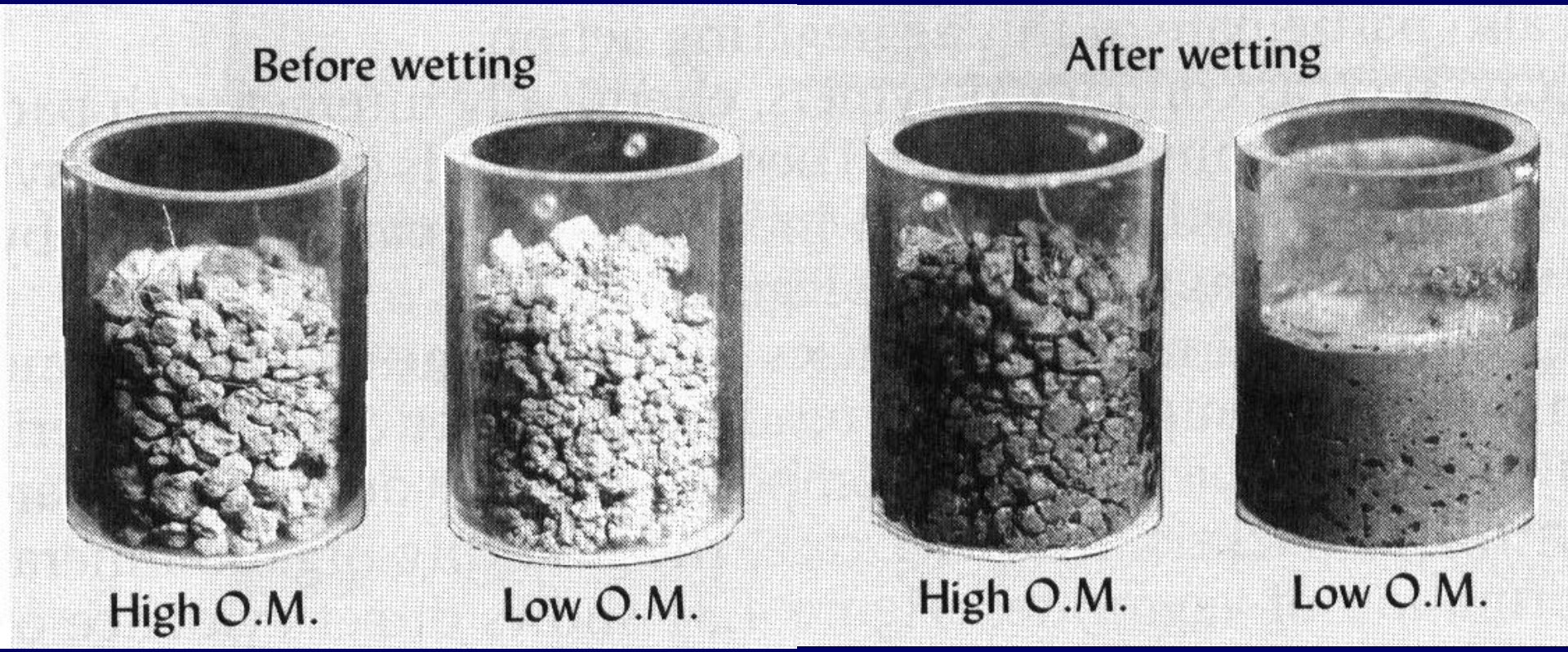
< 1mm

Soil Structural Stability
- particles held & “glued” together



Disturb soil as little as possible!

Effect of OM on structure stability




Soil is habitat!