



Il suolo: aspetti chimici e fisici

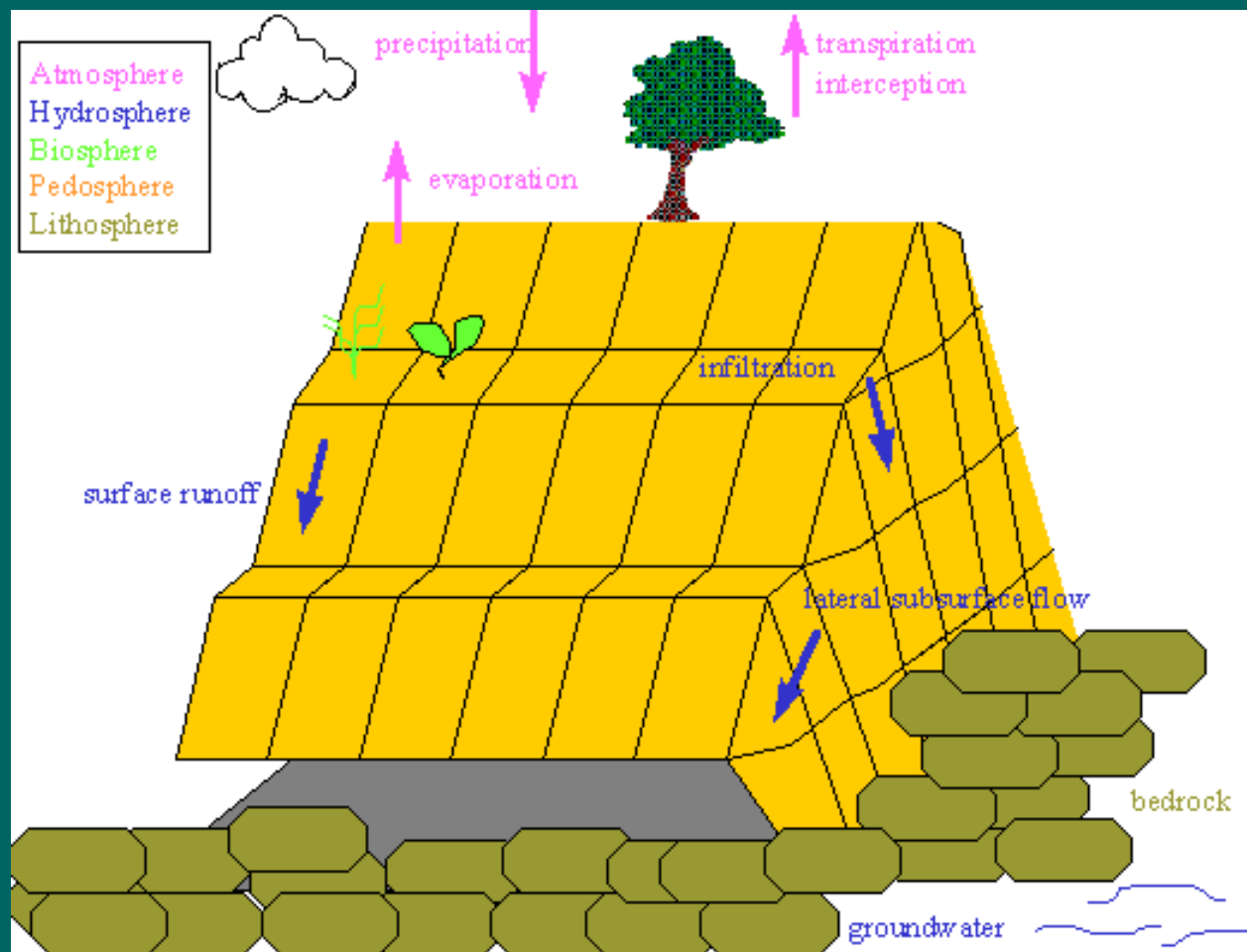
Gilberto Bragato

CRA-RPS

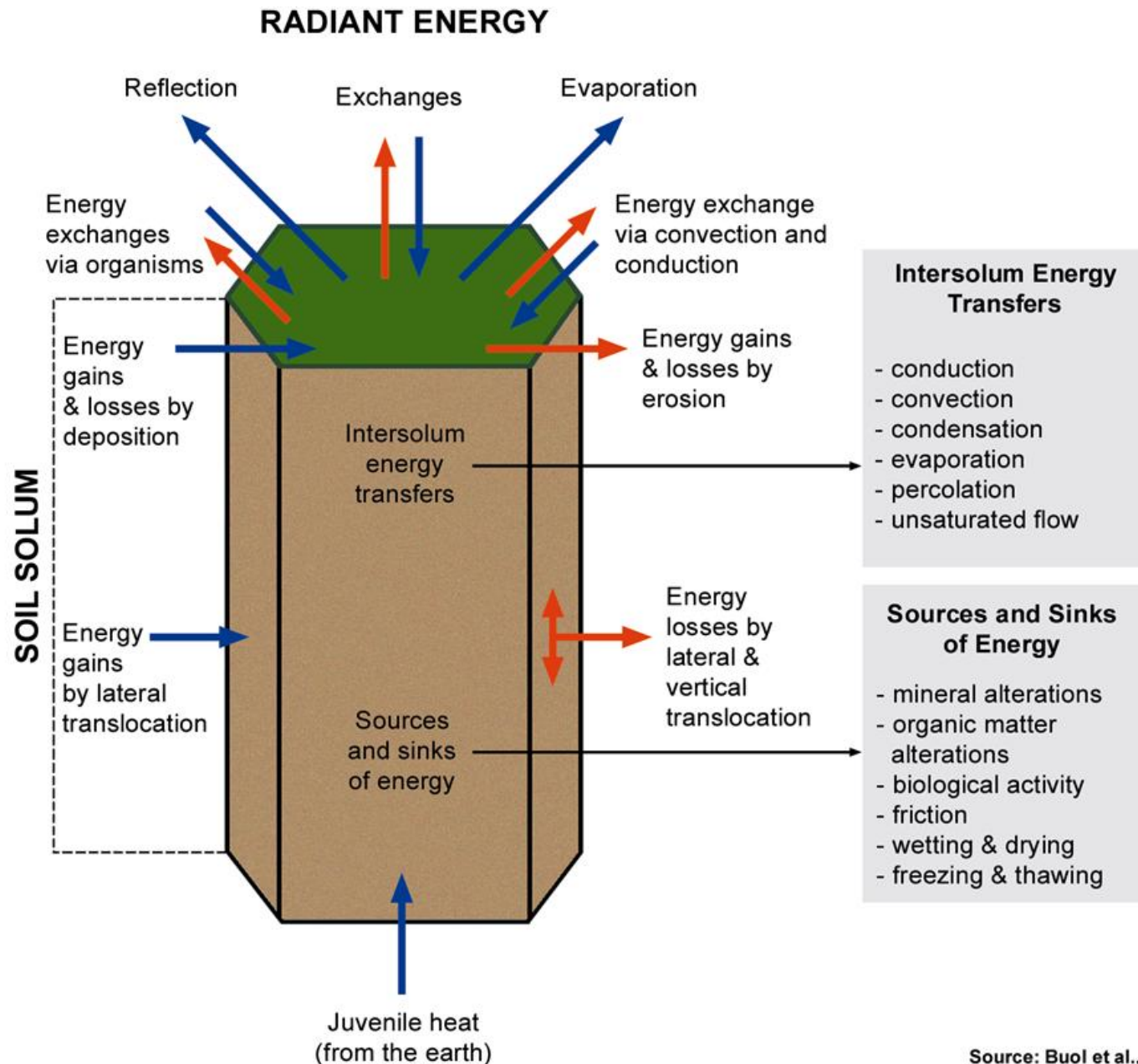
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Cos'è il suolo?

Un sistema aperto complesso in cui biosfera, litosfera, atmosfera e idrosfera interagiscono



Il suolo è un sistema aperto



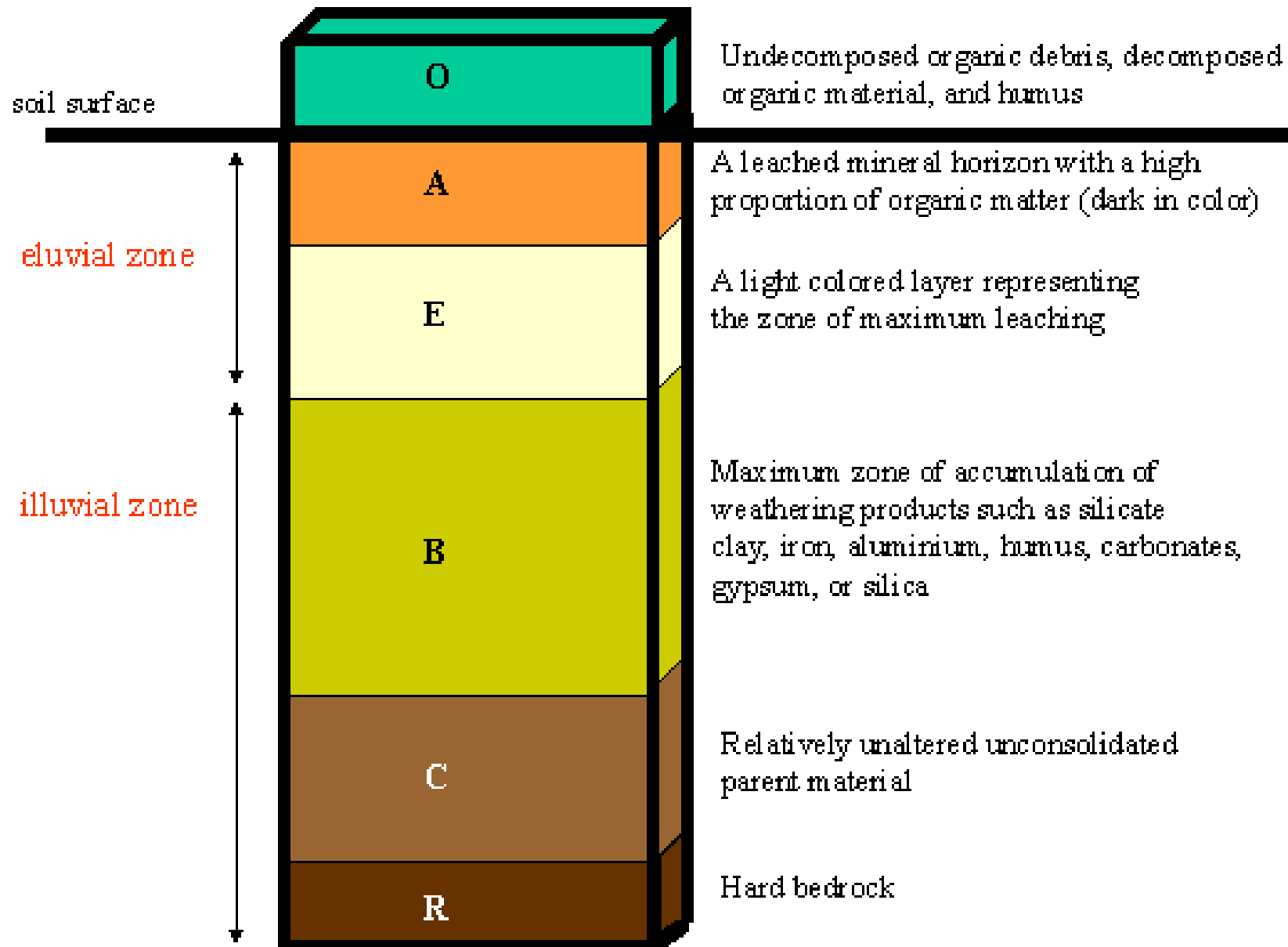
Il suolo è un sistema complesso

- **E' costituito da molteplici componenti, parzialmente indipendenti**
- **Le componenti manifestano rapporti non lineari**
- **I processi sono ridondanti, conferendo resistenza agli stress esterni**
- **Si auto-organizza spontaneamente, acquisendo proprietà emergenti non riducibili alla somma delle sue componenti**

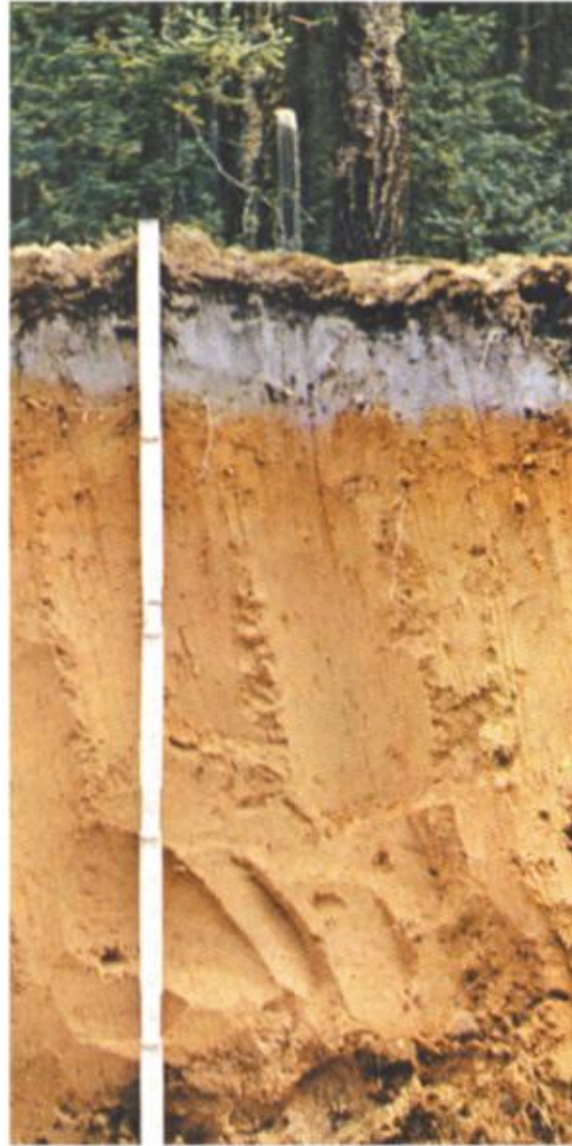
Come ogni altro componente della biogeosfera, il suolo si auto-organizza spontaneamente in modo da acquisire proprietà emergenti non riducibili alla somma dei suoi componenti

- Presenza di molte componenti complesse e parzialmente indipendenti
- Rapporti non lineari tra le componenti.
- Dinamicità e organizzazione gerarchica.
- Processi ridondanti e, di solito, non critici
- Elevata resistenza agli stress esterni.

Auto-organizzazione



Auto-organizzazione

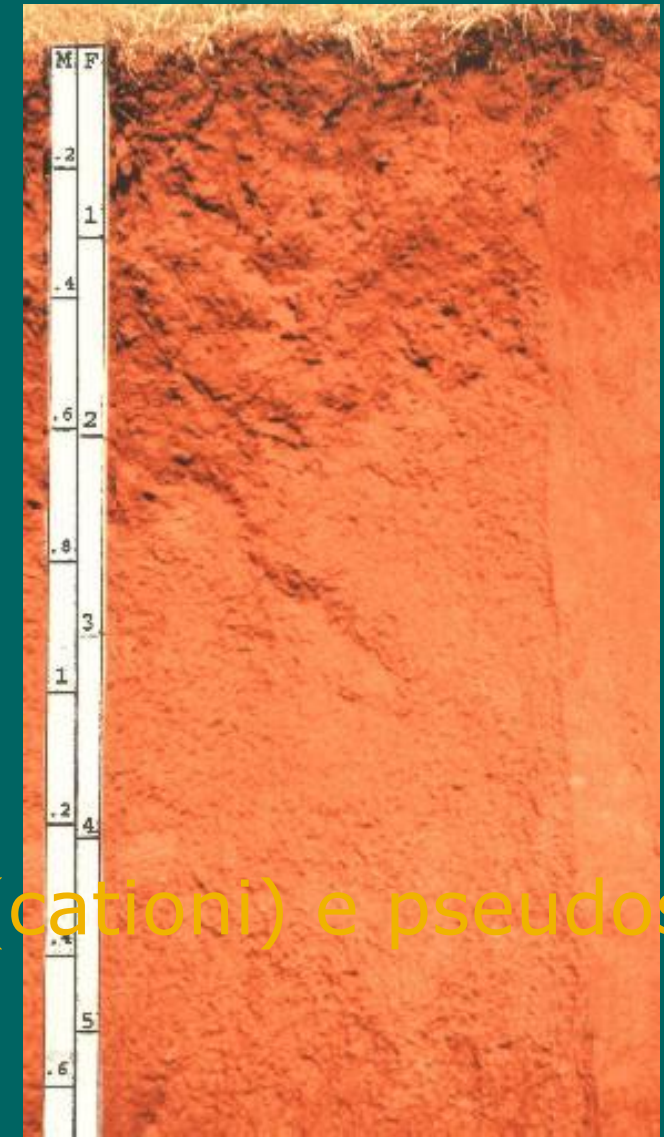


Le rocce, originandosi ad alte pressioni e temper



Al contatto con gli altri elementi della biogeo

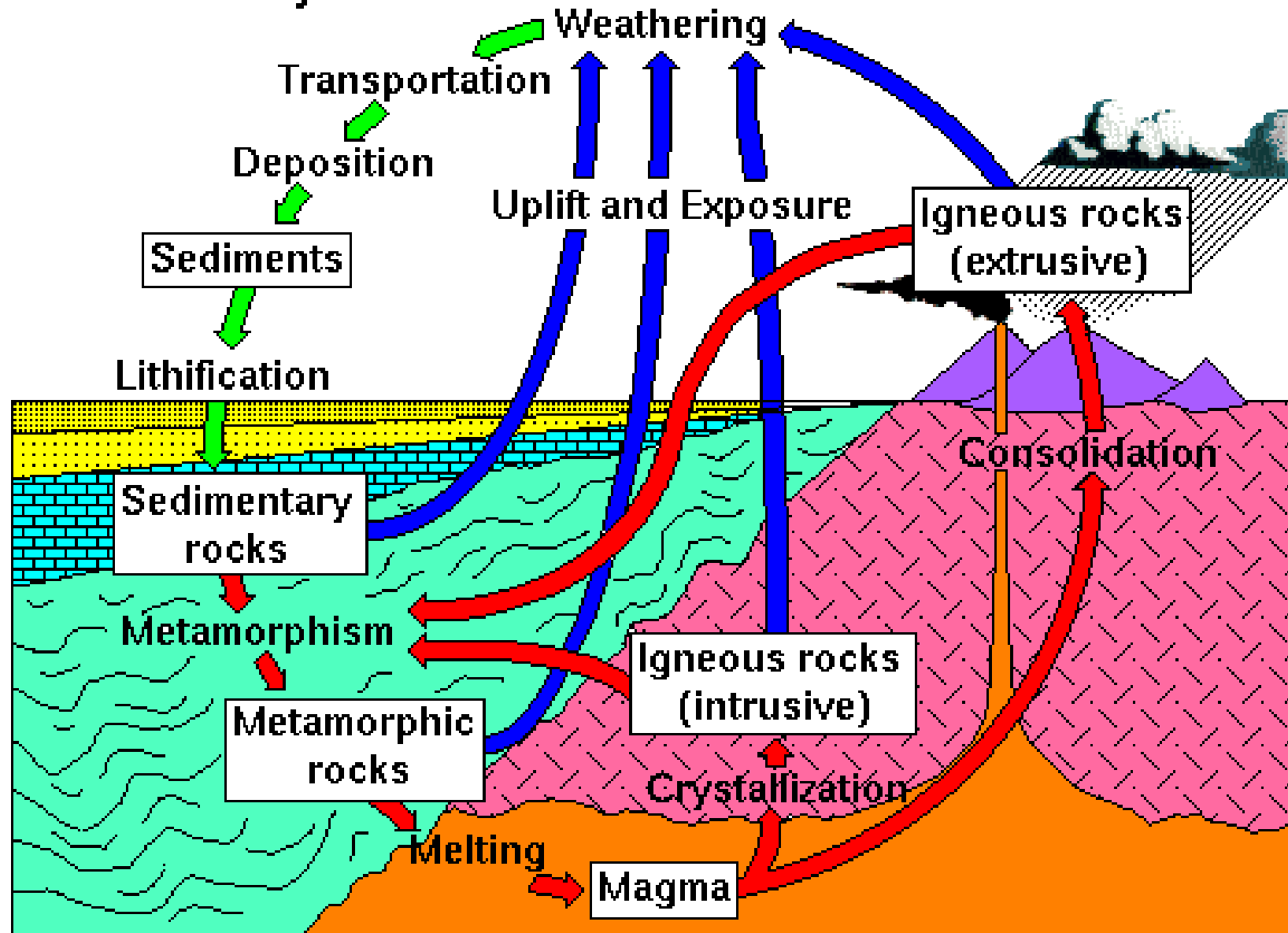
Entropia massima



Perse tutte le componenti solubili (cationi) e pseudosolubili

Il ciclo delle rocce

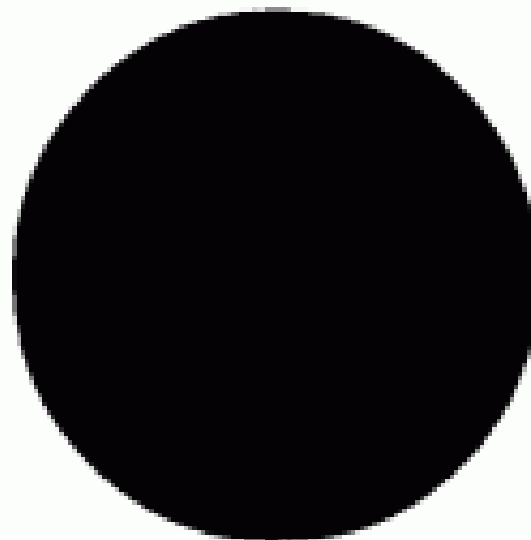
The Rock Cycle



Alterazione



Dimensione delle particelle



Sand
2.00-0.05 mm

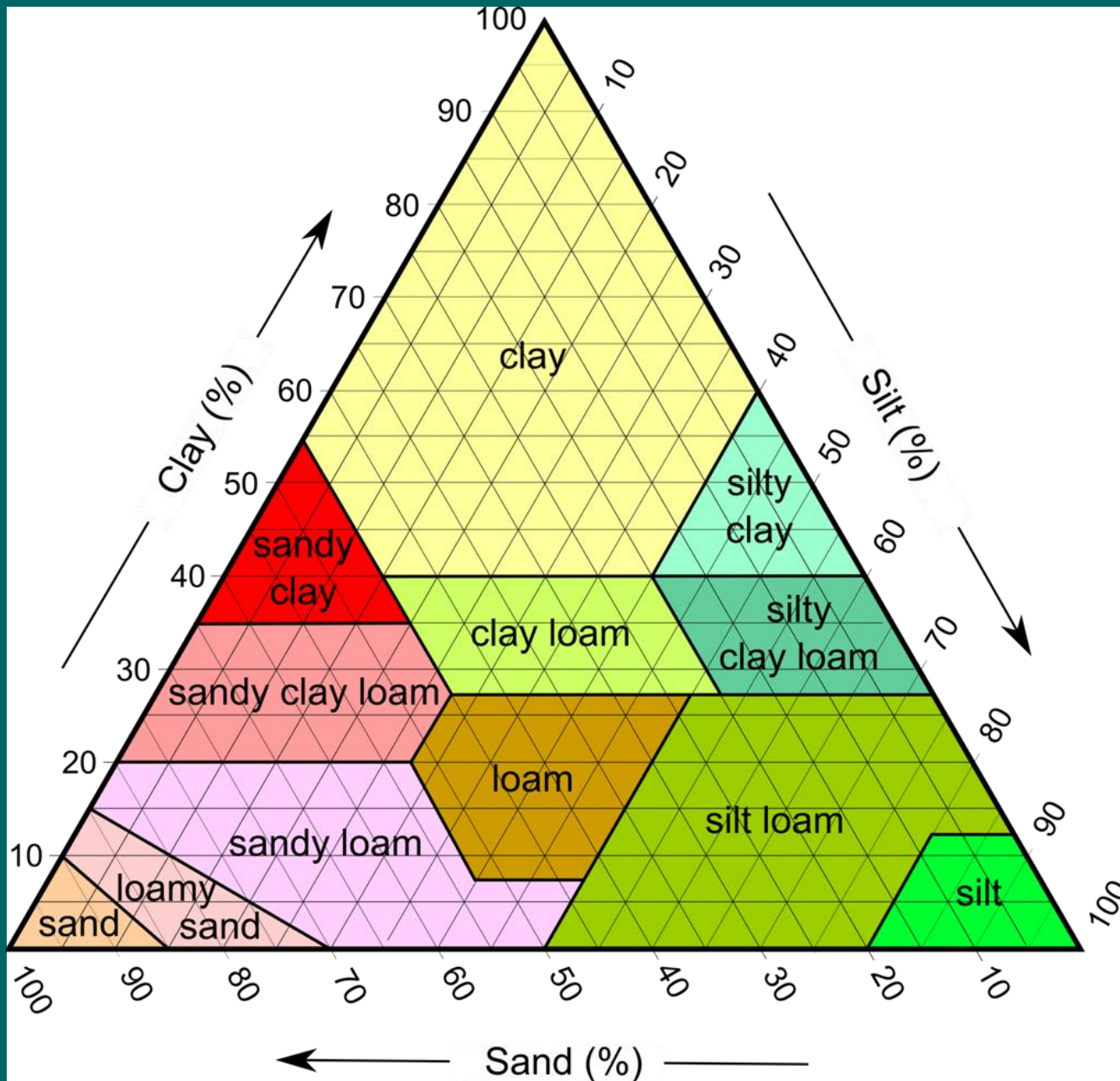


Silt
0.05-0.002 mm

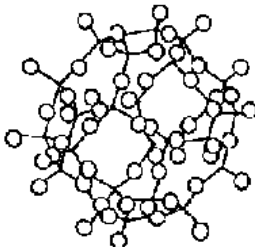
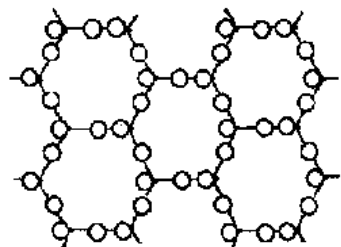
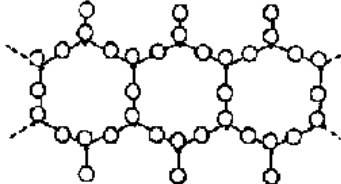
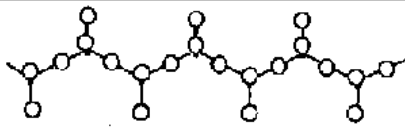

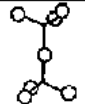
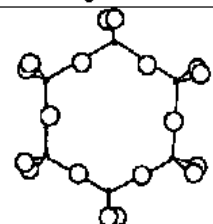


Clay
<0.002 mm

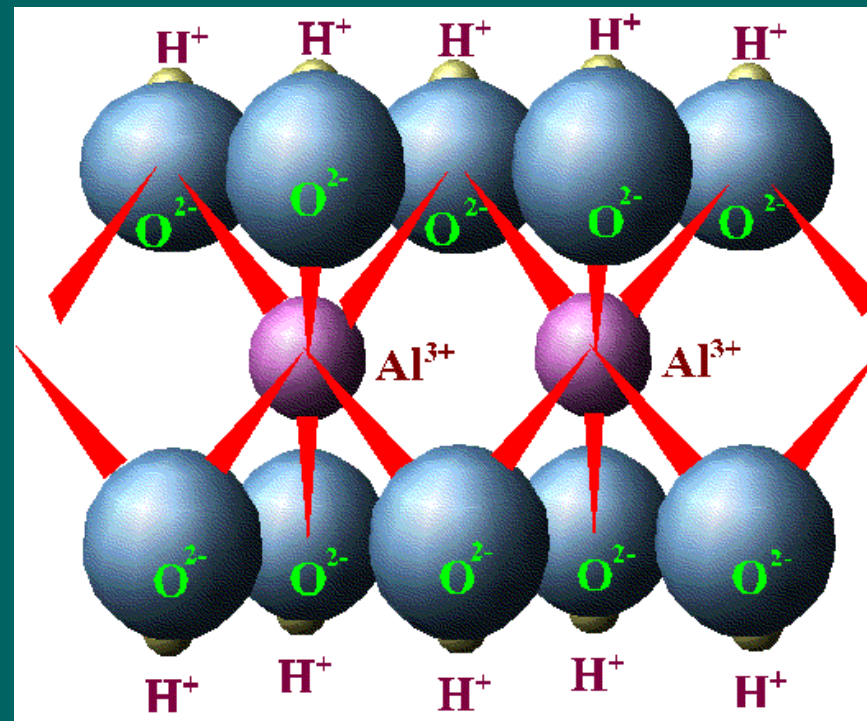
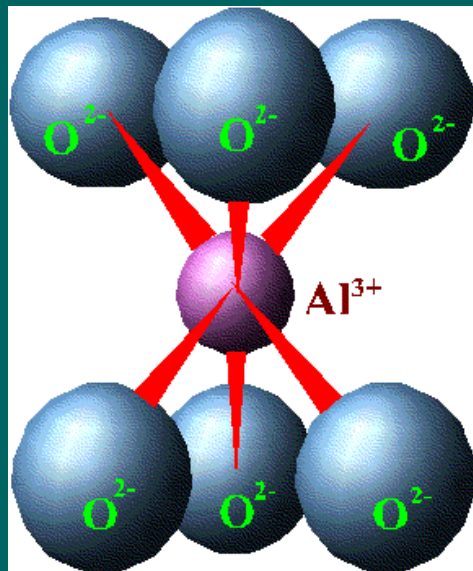
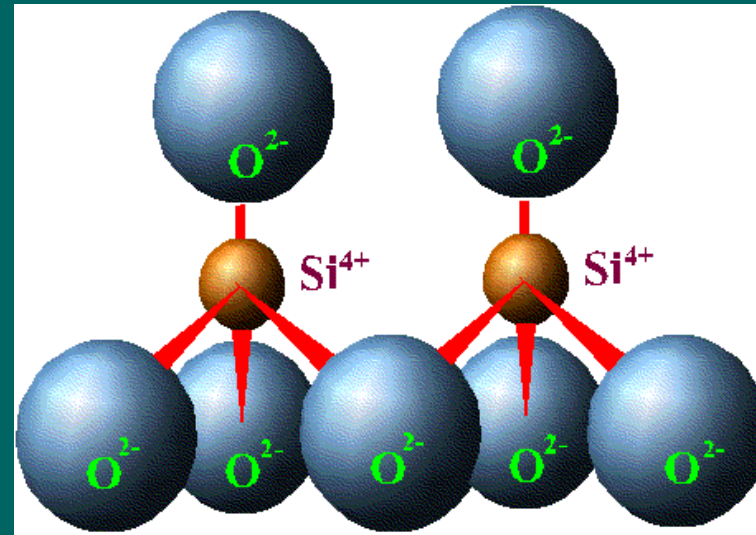
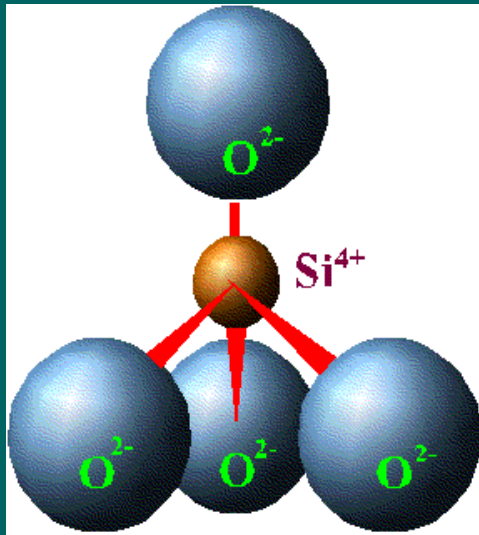
Triangolo tessiturale



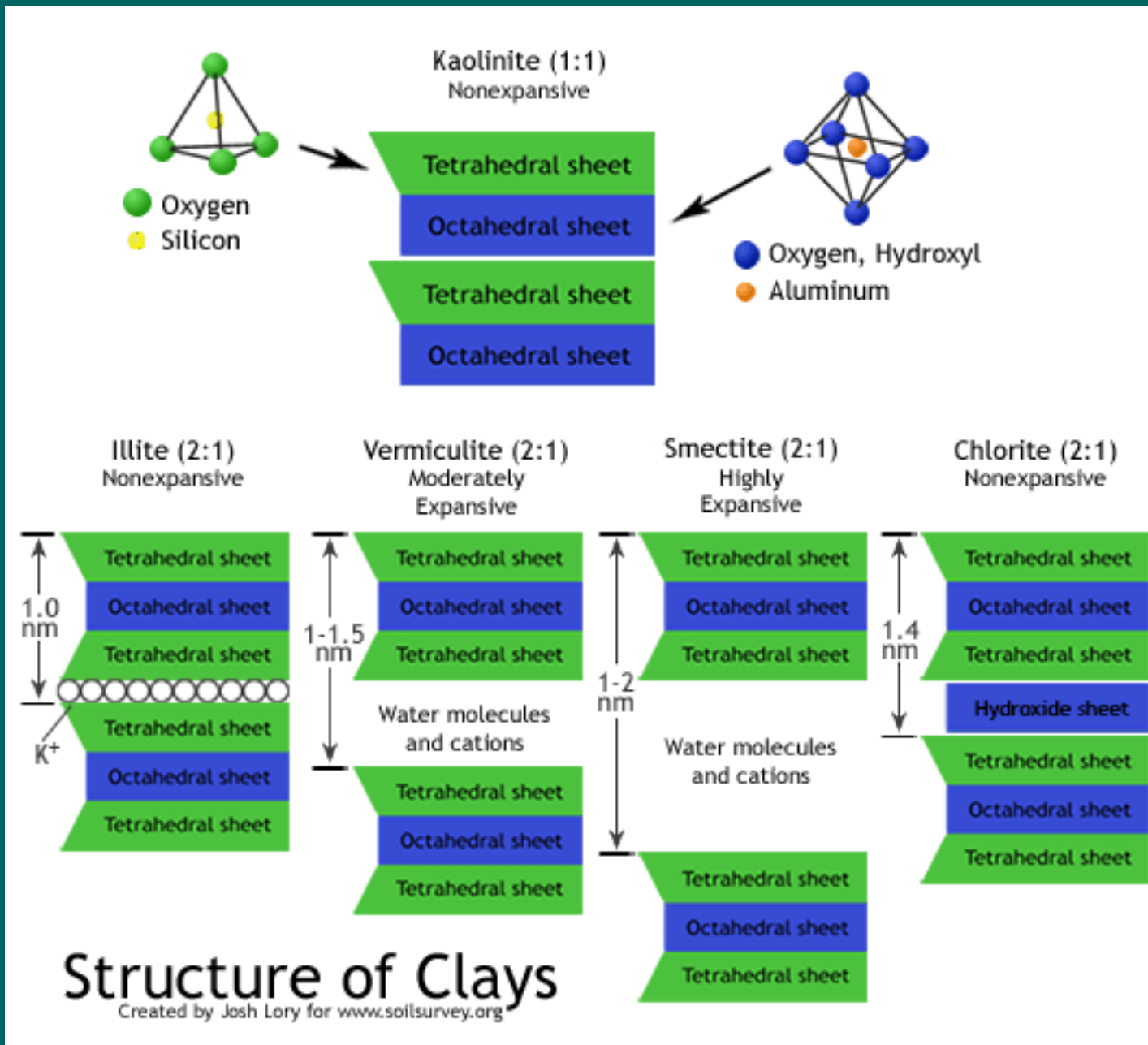
Silicati e alluminati

Primary minerals	Silicate classification	3D Structure	Importance
Quartz Feldspar	Tectosilicates		Abundant in sand and silt Abundant in soil that is not leached
Mica	Phyllosilicates		Source of K in most temperate zones
Amphibole	Inosilicates		Easily weathered to clay minerals
Pyroxene	Inosilicates		Easily weathered
Olivine	Nesosilicates		Easily weathered
Epidote	Sorosilicates		Highly resistant to chemical weathering, used as 'index mineral'
Tourmaline	Cyclosilicates		Highly resistant to chemical weathering

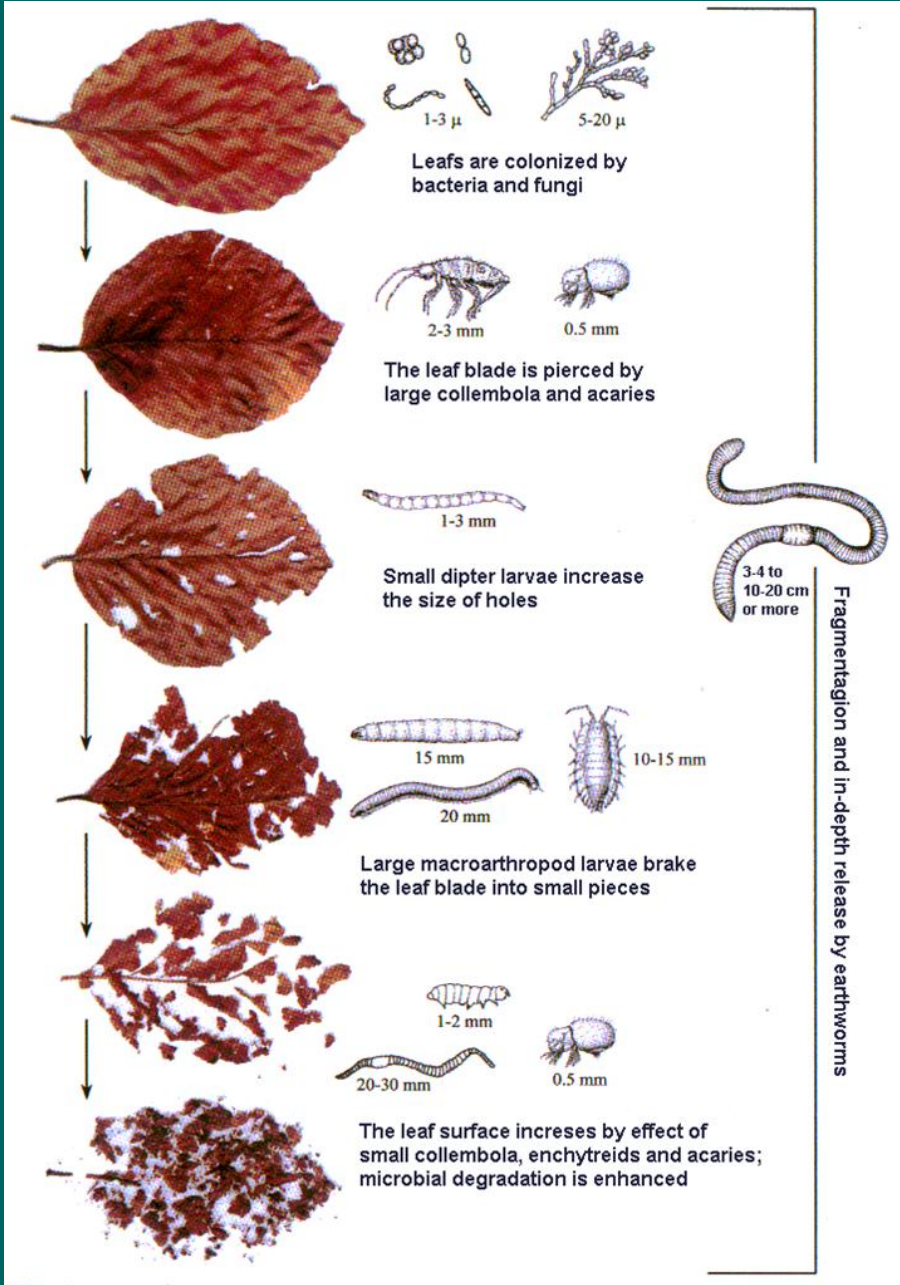
Silicati e alluminati



Argille



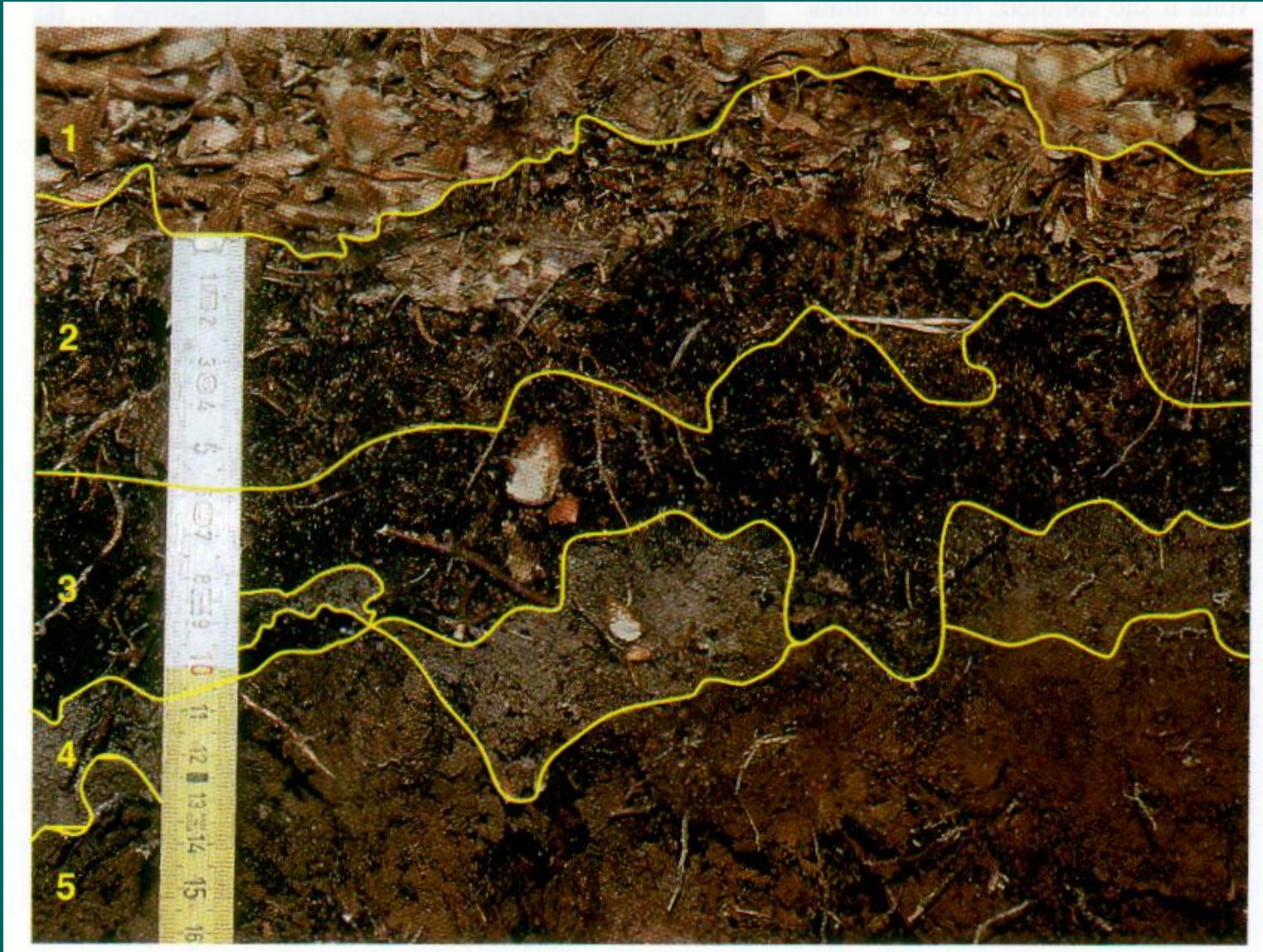
Sostanza organica



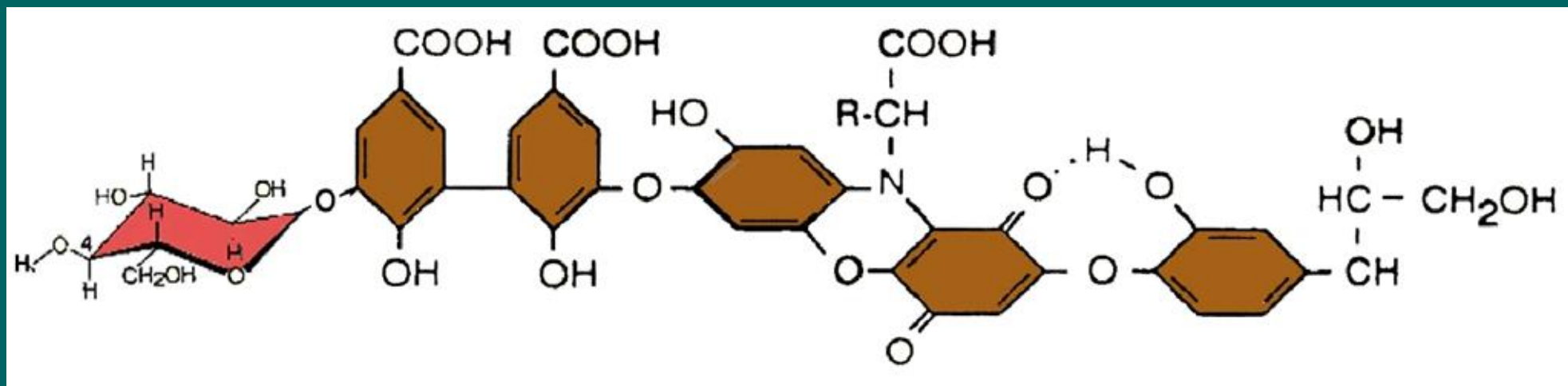
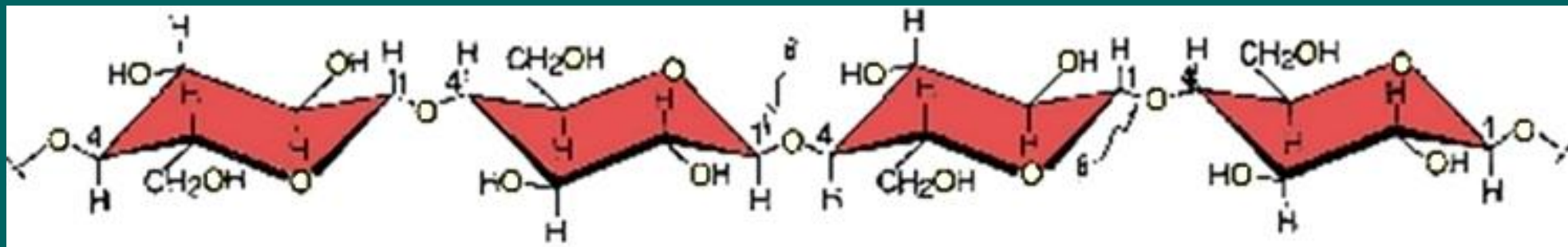
Mull



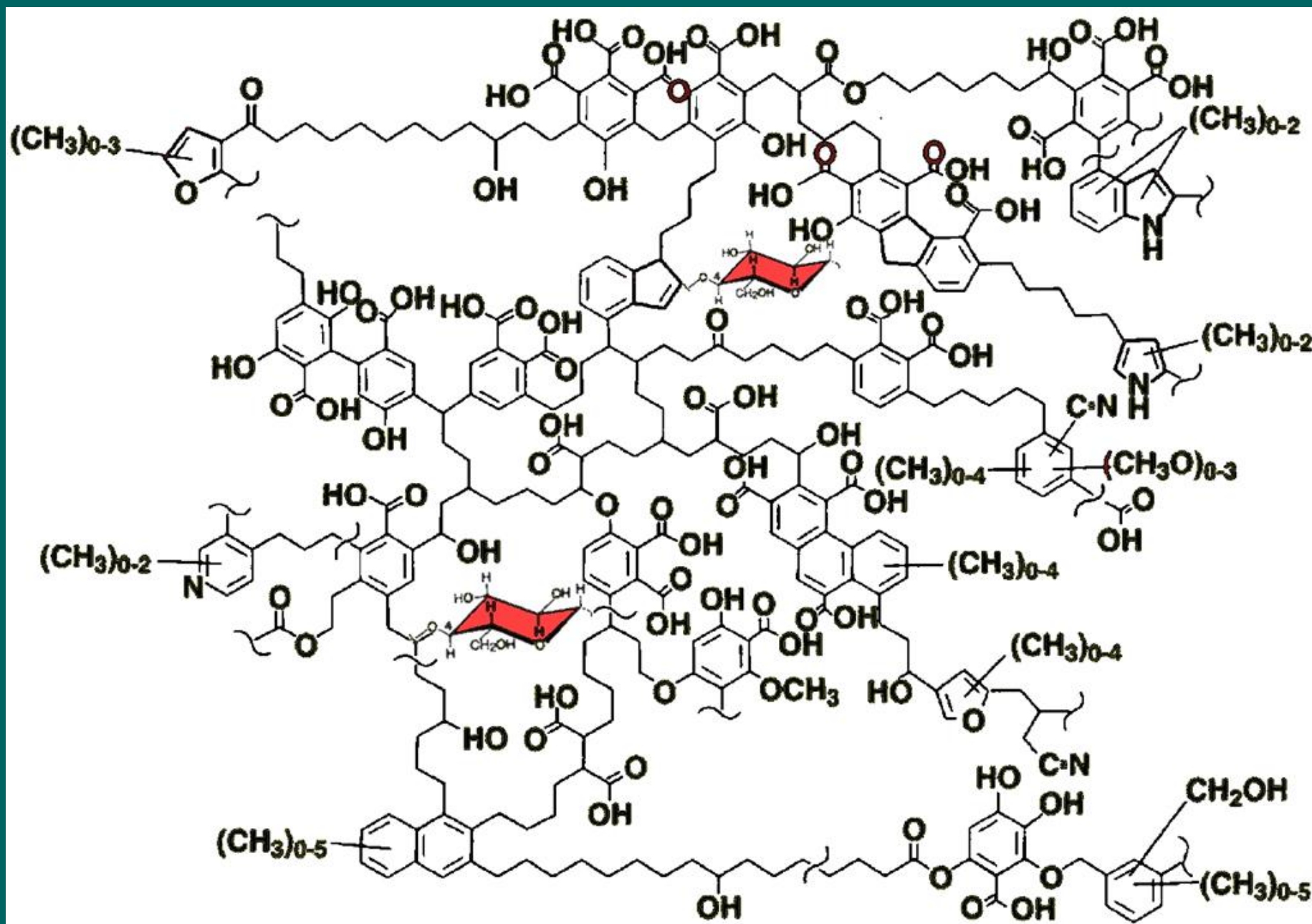
Mor



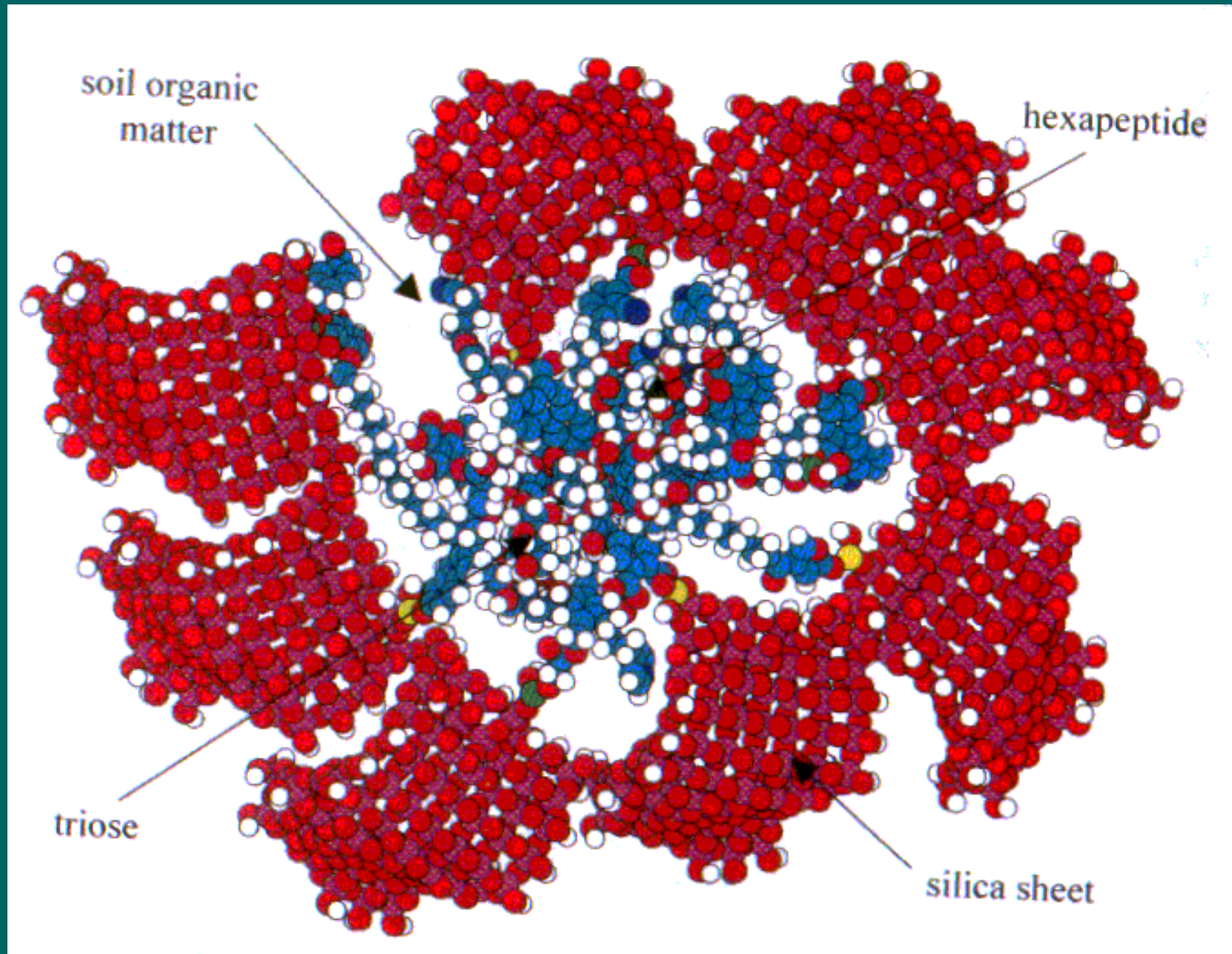
Prodotti di partenza



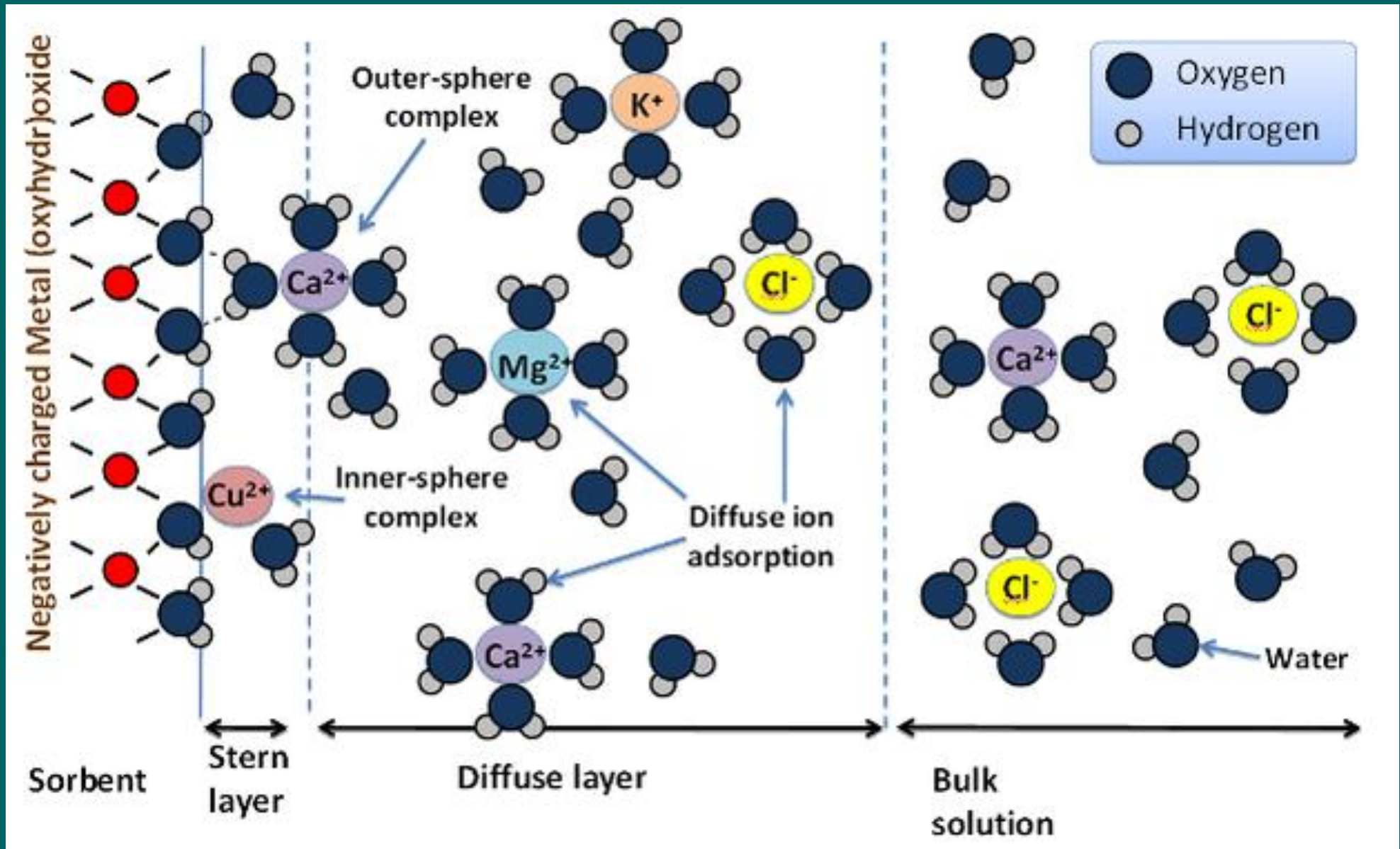
Prodotti di arrivo



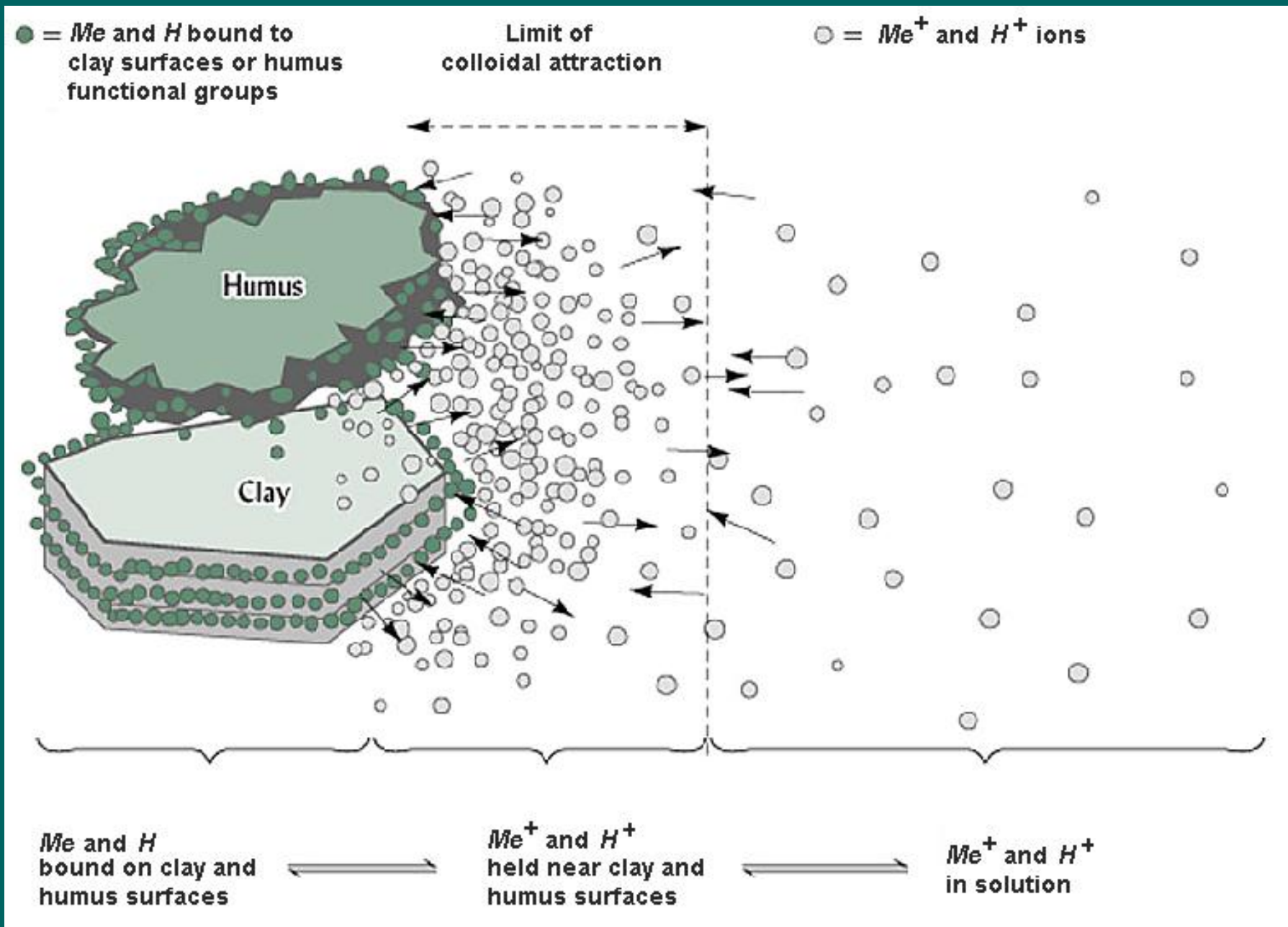
Particelle organo-minerali



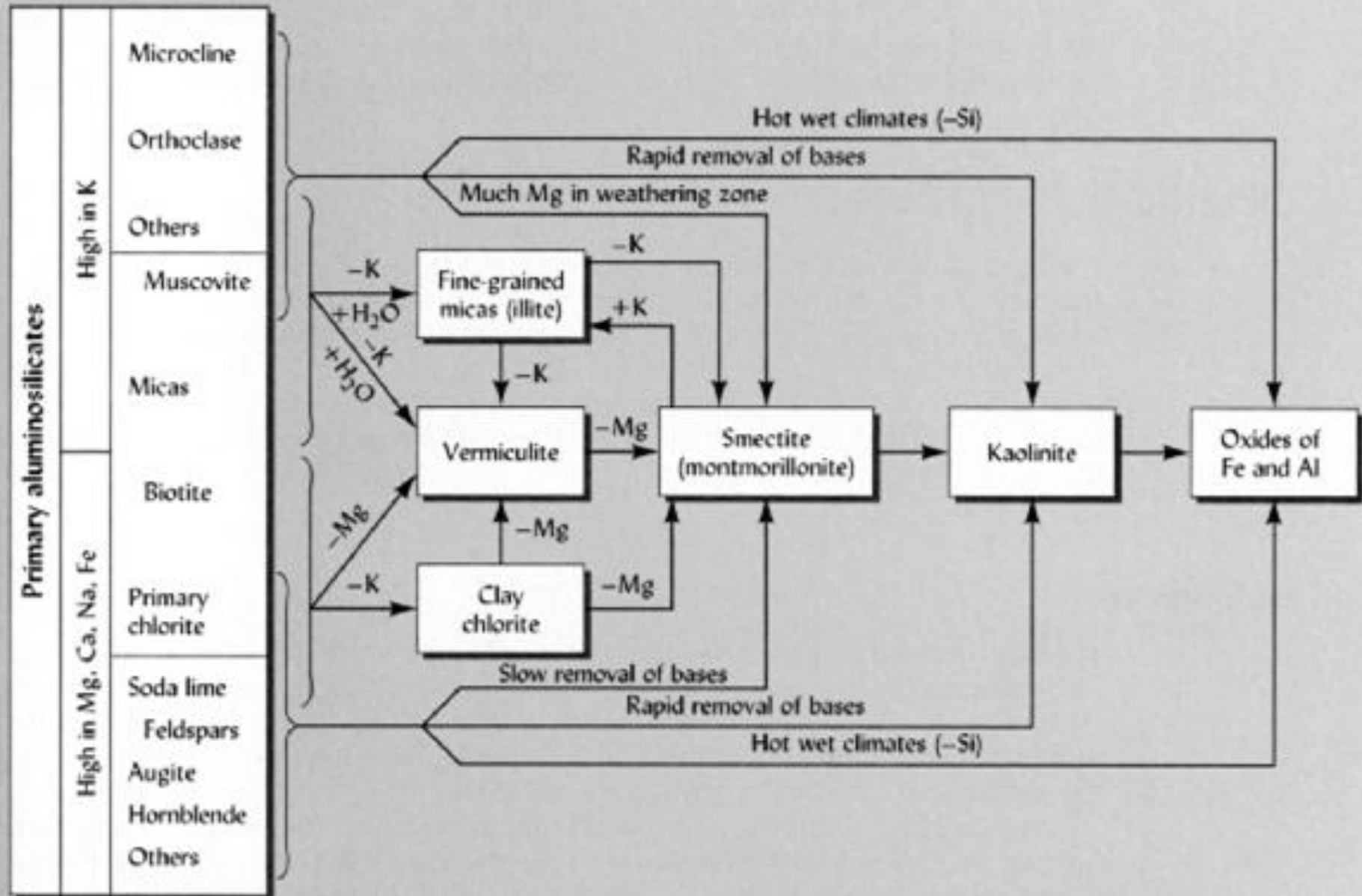
Scambio cationico



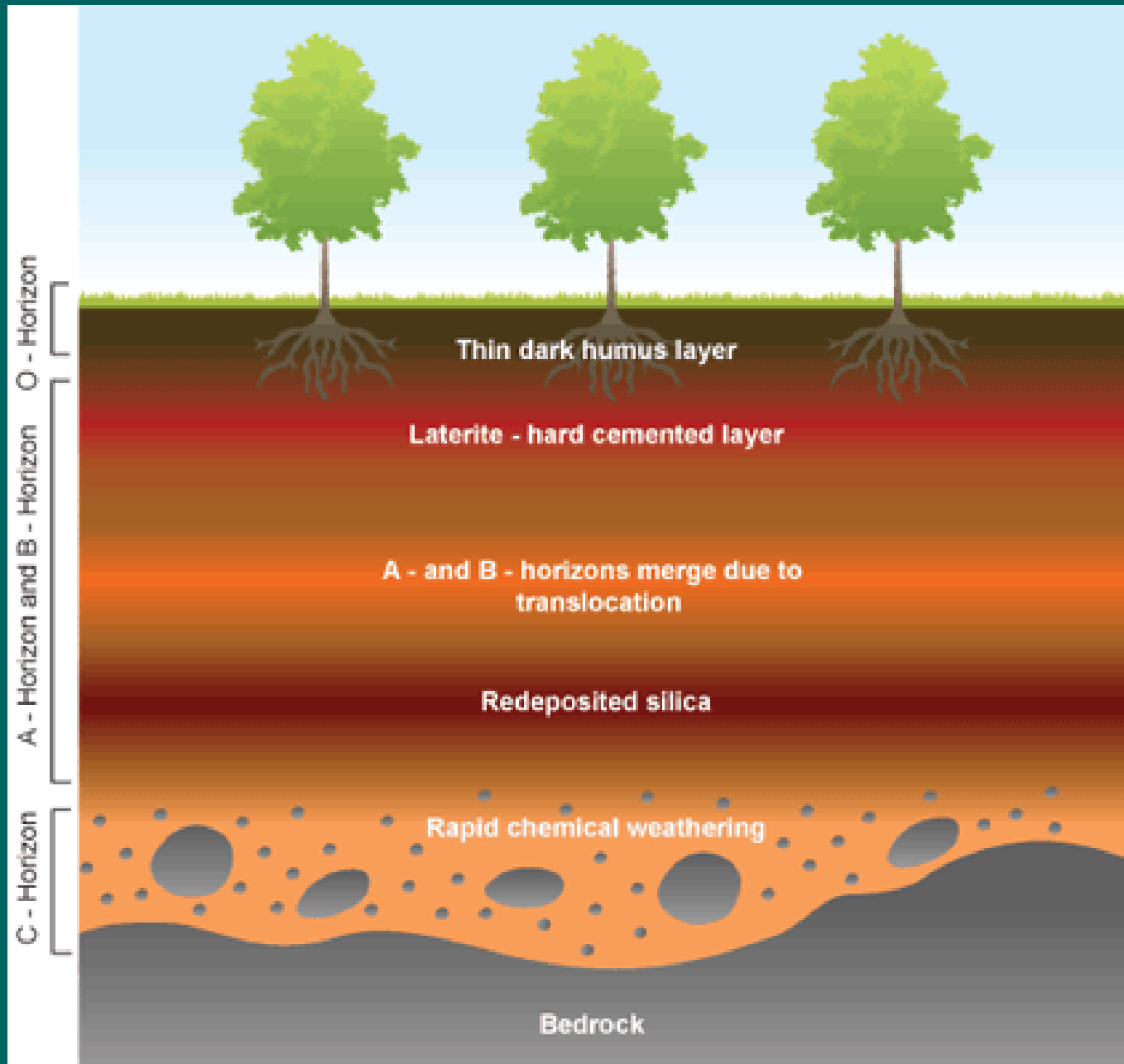
Scambio cationico



Argille



Risultato dell'argillogenesi



Soil Structure



Granular



Blocky

1 inch



Platy



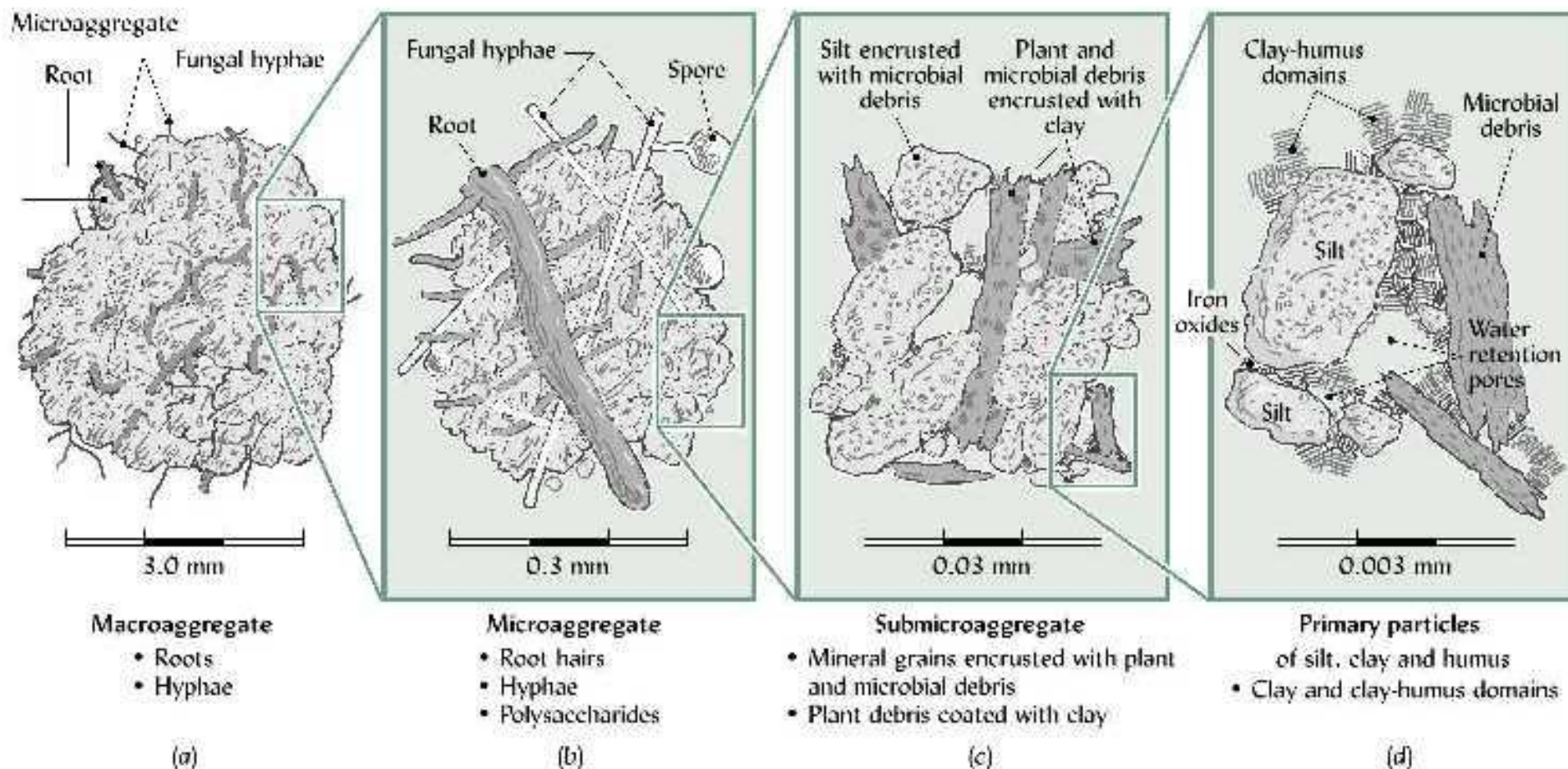
Massive



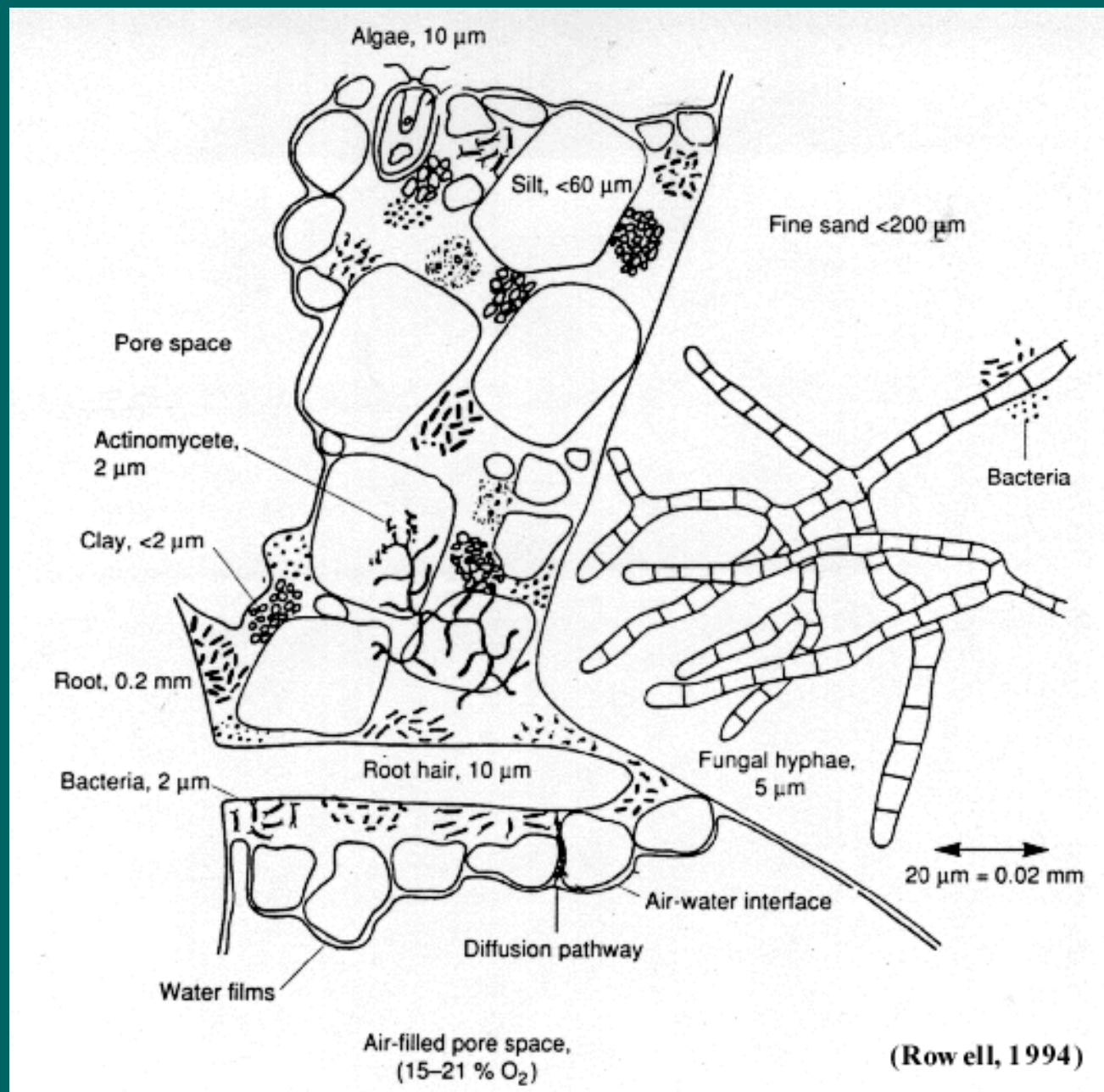
Single grain

Aggregazione

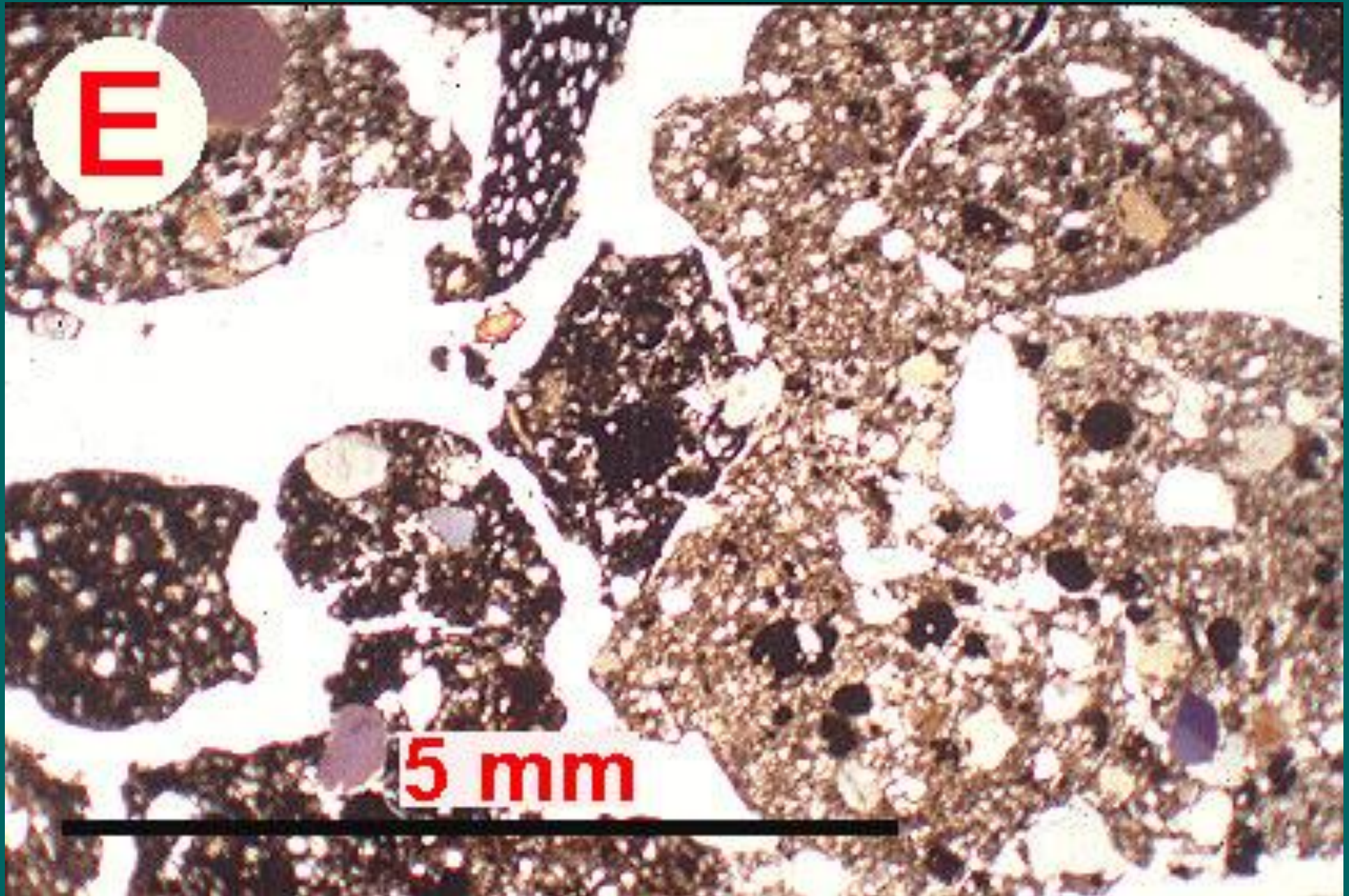




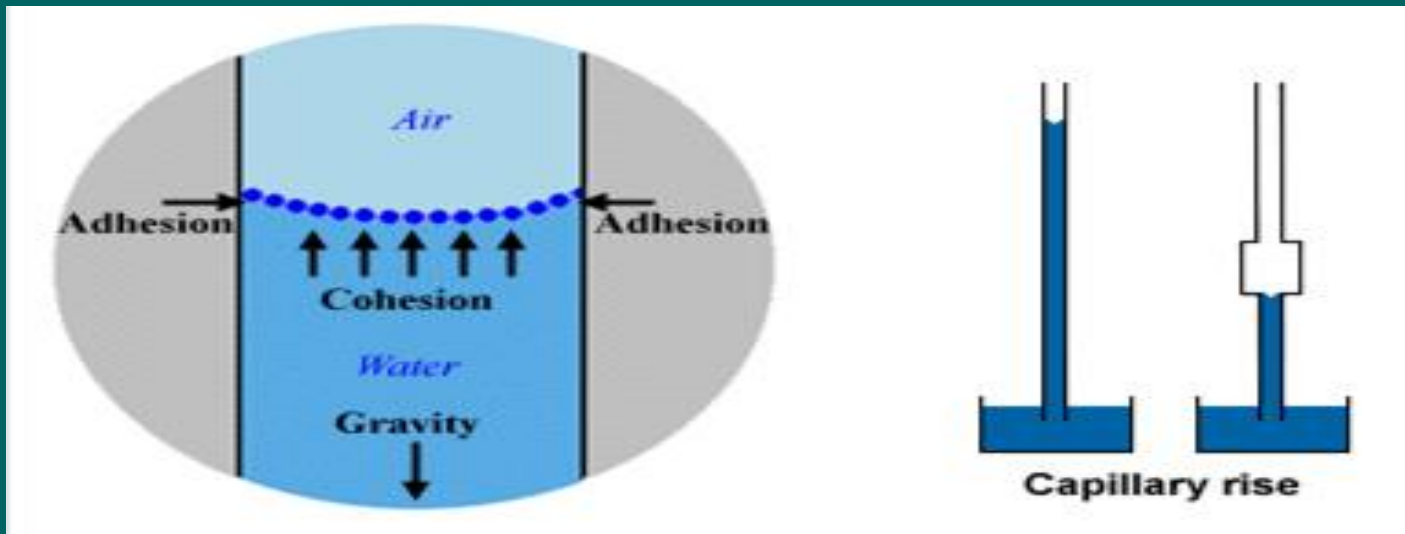
Micro auto-organizzazione



Micro auto-organizzazione

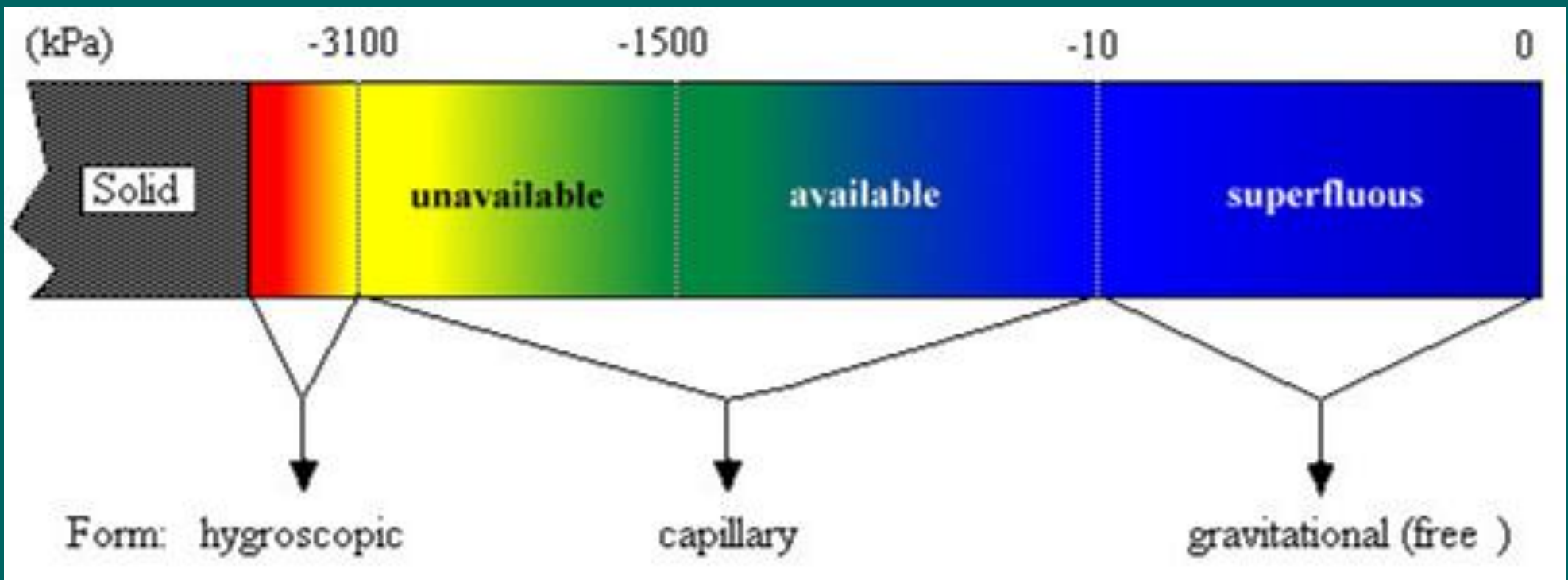


L'acqua nei pori



$$h = \frac{4\tau \cos \alpha}{\gamma d}$$

$$d = \frac{0.3}{h}$$



Alcune variabili fisiche

Particle density	$\rho_s = \frac{M_{solids}}{V_{solids}}$
Bulk density	$\rho_b = \frac{M_{solids}}{V_{sample}} = \frac{M_{solids}}{V_{air} + V_{water} + V_{solids}}$
Porosity	$\phi = \frac{V_{air} + V_{water}}{V_{air} + V_{water} + V_{solids}} = 1 - \frac{\rho_b}{\rho_s}$
Volumetric water content	$\theta = \frac{V_{water}}{V_{solids}}$
Degree of saturation	$S = \frac{\theta}{\phi}$

Un paio di misurazioni

