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ASAC 1101 : FUNDAMENTALS OF SOIL SCIENCE (2+1)

Level : B.Sc (Ag), I semester

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SOIL SCIENCE AND AGRICULTURAL CHEMISTRY

**M.S.SWAMINATHAN SCHOOL OF AGRICULTURE,CUTM,
PARLAKHEMUNDI**

Topic

Soil structure

Soil structure

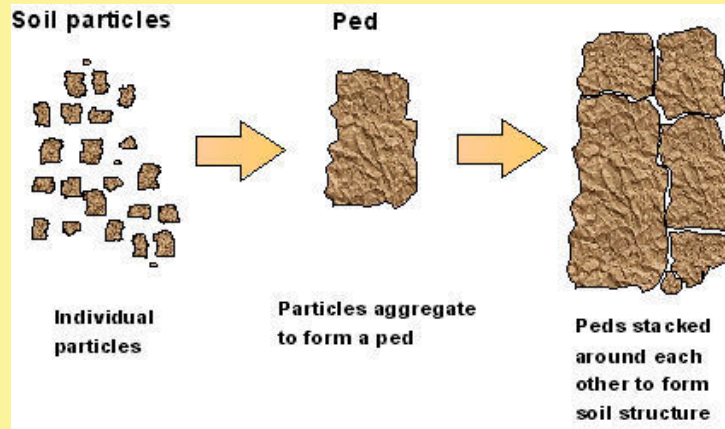
- **Arrangement of the primary soil particles (sand, silt, and clay) and other soil materials into discrete aggregates**

Description of field soil structure

- Soil structure is described in terms of
 - **Type** (or) shape of peds
spherical, platy, blocky and prism-like etc.
 - **Relative size** of peds
fine, medium, coarse
 - **Grades** (or) degree of development of peds
strong, moderate, weak

Peds

- Structural units are called *peds*, and have distinct boundaries and well-defined planes of weakness between the aggregates
- Peds consist of primary particles bound together by cementing agents like organic matter, clay, and hydrous oxides of iron and aluminum
- Peds can take several shapes

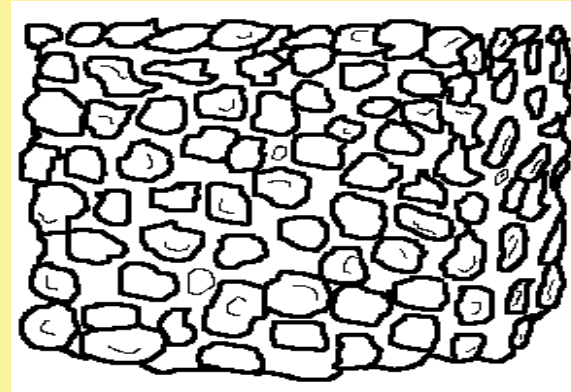


Ped shapes

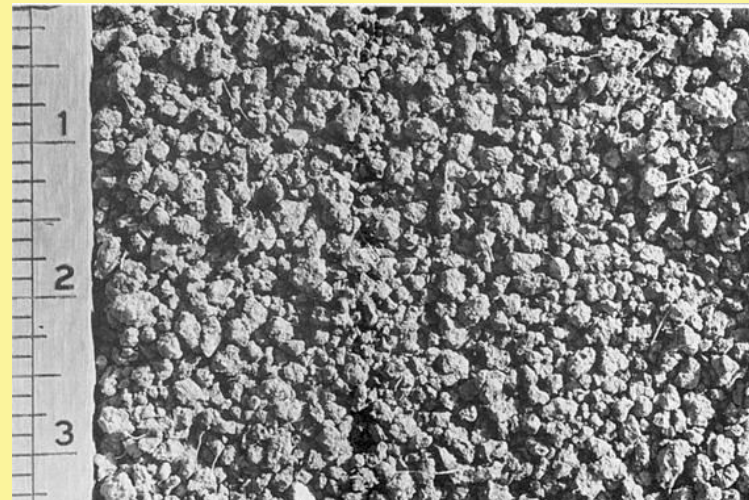
- **Granular and Crumb (Spheroidal)**
- **Blocky**
- **Prismatic**
- **Columnar**
- **Platy**
- **Single-grained**
- **Massive**

Granular structure

- Resembles cookie crumbs and is usually less than 0.5 cm in diameter
- Commonly found in surface horizons where roots have been growing

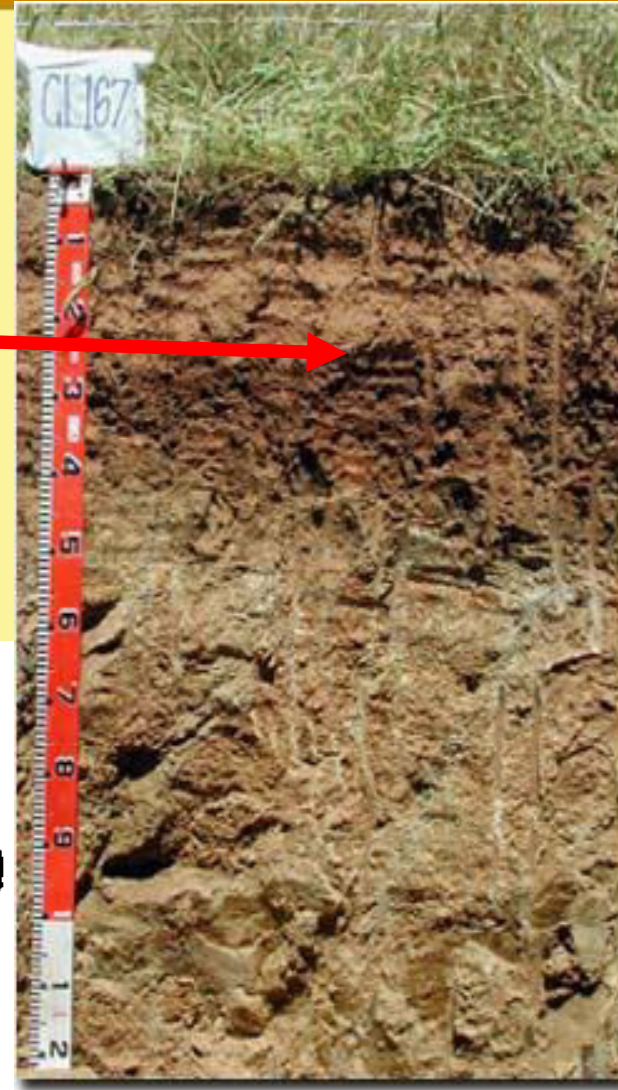
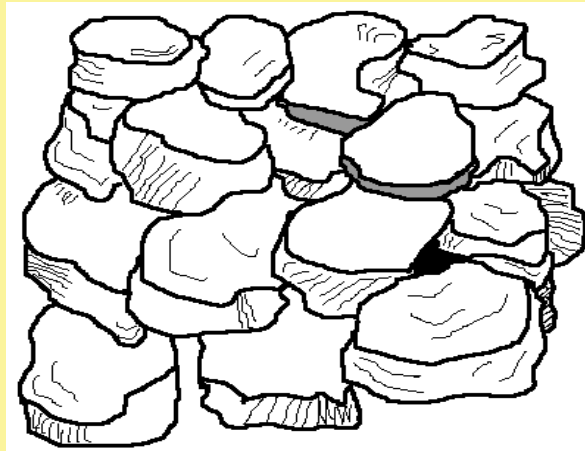


<http://soil.gsfc.nasa.gov/pvg/granular.gif>



Blocky structure

- Irregular blocks that are usually 1.5 - 5.0 cm in diameter
- Can be subangular or angular blocky



Blocky structure

Block-like

Common in B horizons, particularly in humid regions. May occur in A horizons.

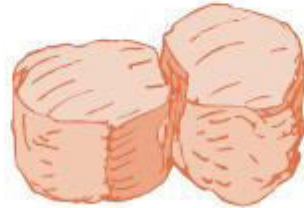
Angular blocky



(c)



Subangular blocky



(d)



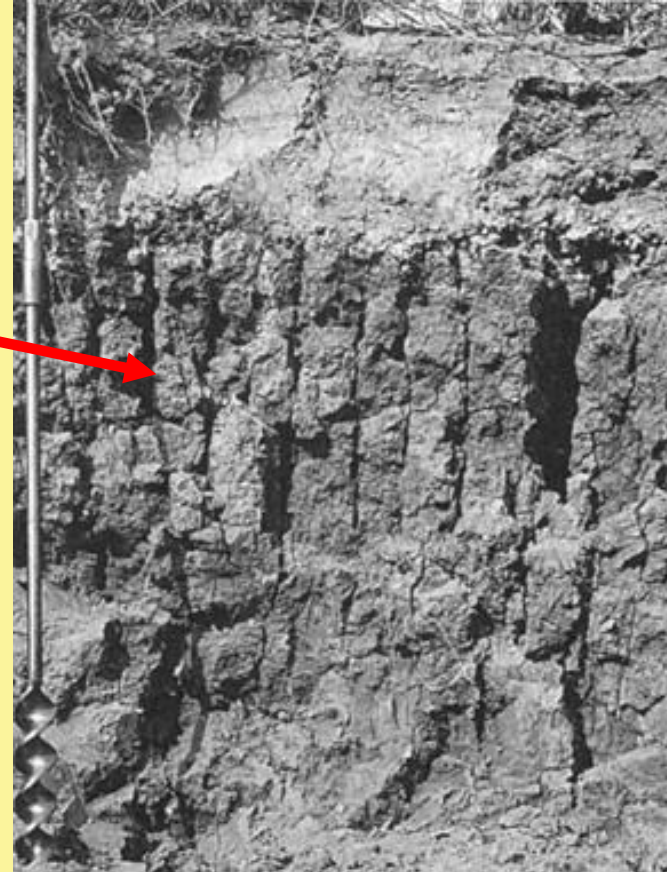
5 to 50mm across

Prismatic structure

- Vertical columns of soil that might be a number of cm long
- Usually found in lower horizons



<http://soil.gsfc.nasa.gov/pvg/prismatic.gif>



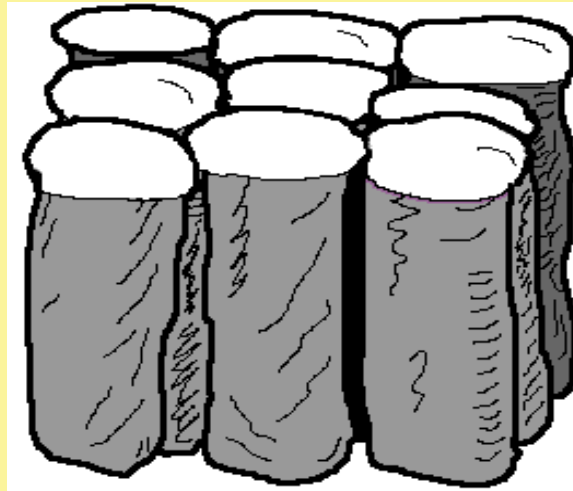
http://soils.usda.gov/technical/manual/images/fig3-27_large.jpg

Columnar structure

- Vertical columns of soil that have a salt "cap" at the top
- Found in soils of arid climates

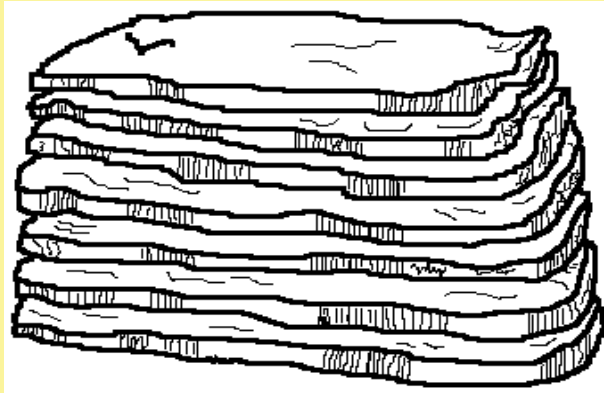


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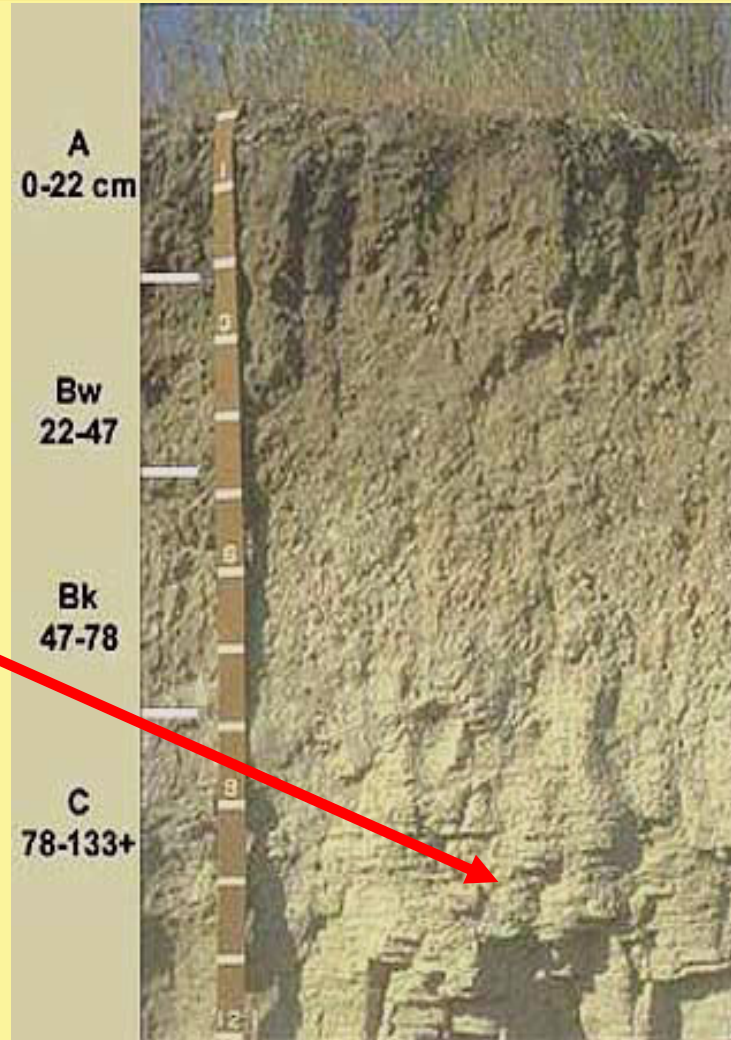


Platy structure

- Thin, flat plates of soil that lie horizontally
- Usually found in compacted soil



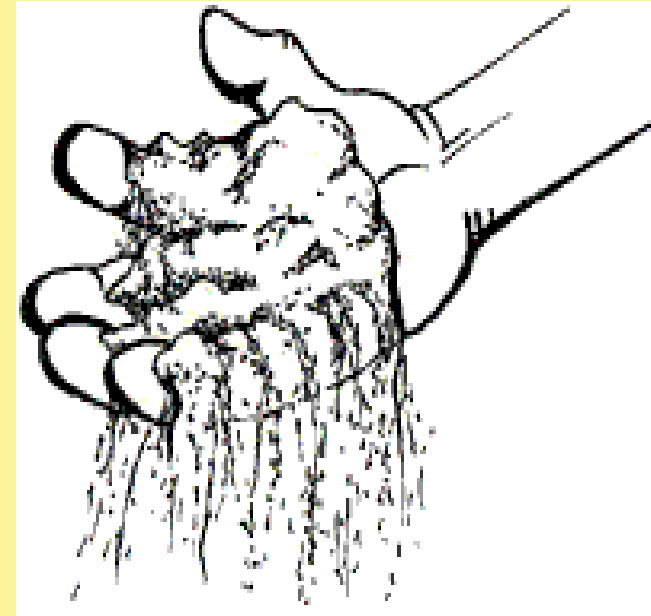
<http://soil.gsfc.nasa.gov/pvg/platy.gif>



<http://soil.gsfc.nasa.gov/pvg/platy.gif>

Single-grained structure

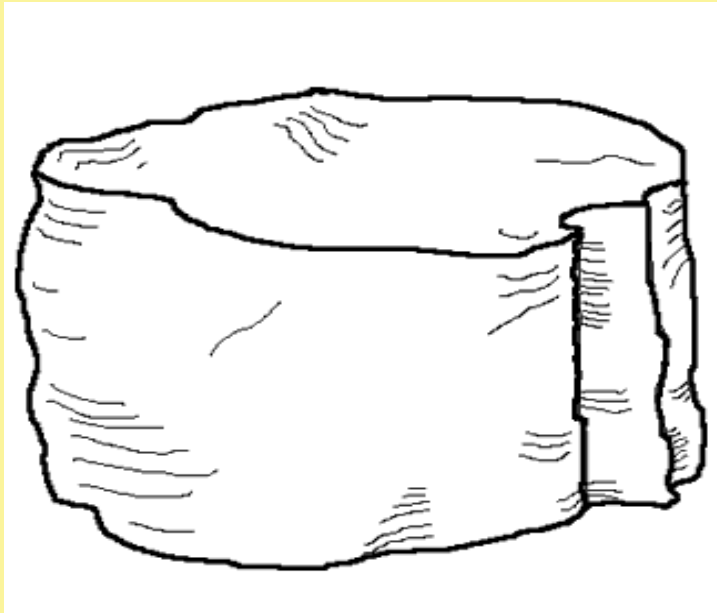
- Soil is broken into individual particles that do not stick together
- Always accompanies a loose consistence
- Commonly found in sandy soils



<http://soil.gsfc.nasa.gov/pvg/singlegrained.gif>

Massive structure

- Soil has no visible structure, is hard to break apart and appears in very large clods



http://soils.usda.gov/technical/manual/images/fig3-31_large.jpg

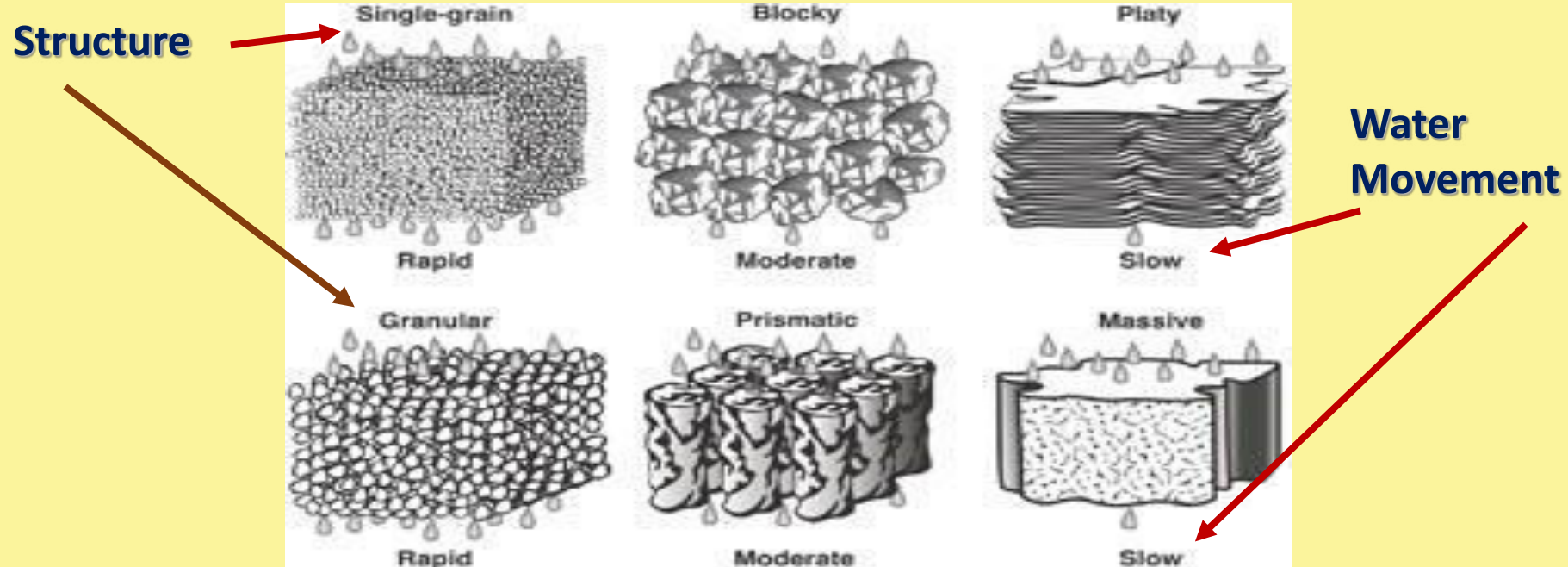
Class of soil structure

- **The size or class of the peds is described as fine, medium, or coarse**

How does structure affect water movement in soils?

- **In soils with good structure, the pore space that occurs between peds is relatively large and facilitates water and air movement**
- **Well-developed structure is very important in clayey soils**
- **Clayey soils with poor structure restrict water and air movement**

Degree of water movement



Altering soil structure

- Unlike texture, structure can be altered by tillage
- Tilling soils that are too wet, or compacting soils with heavy equipment can break down the natural structural units



<http://www.ny.nrcs.usda.gov/programs/images/tractor-tillin.jpg>

Description of field soil structure



“Weak, medium, angular blocky” structure

Individual blocky ped

Description of field soil structure

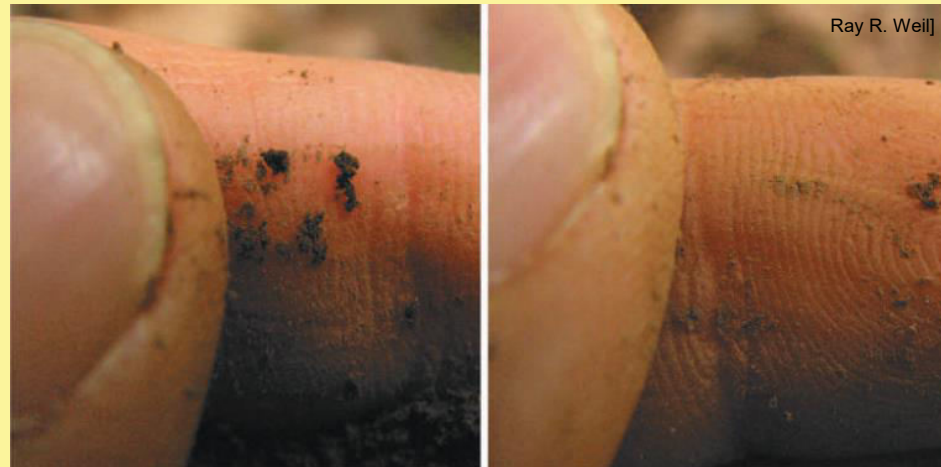


Ray R. Weil

“Strong, very coarse, prismatic” structure

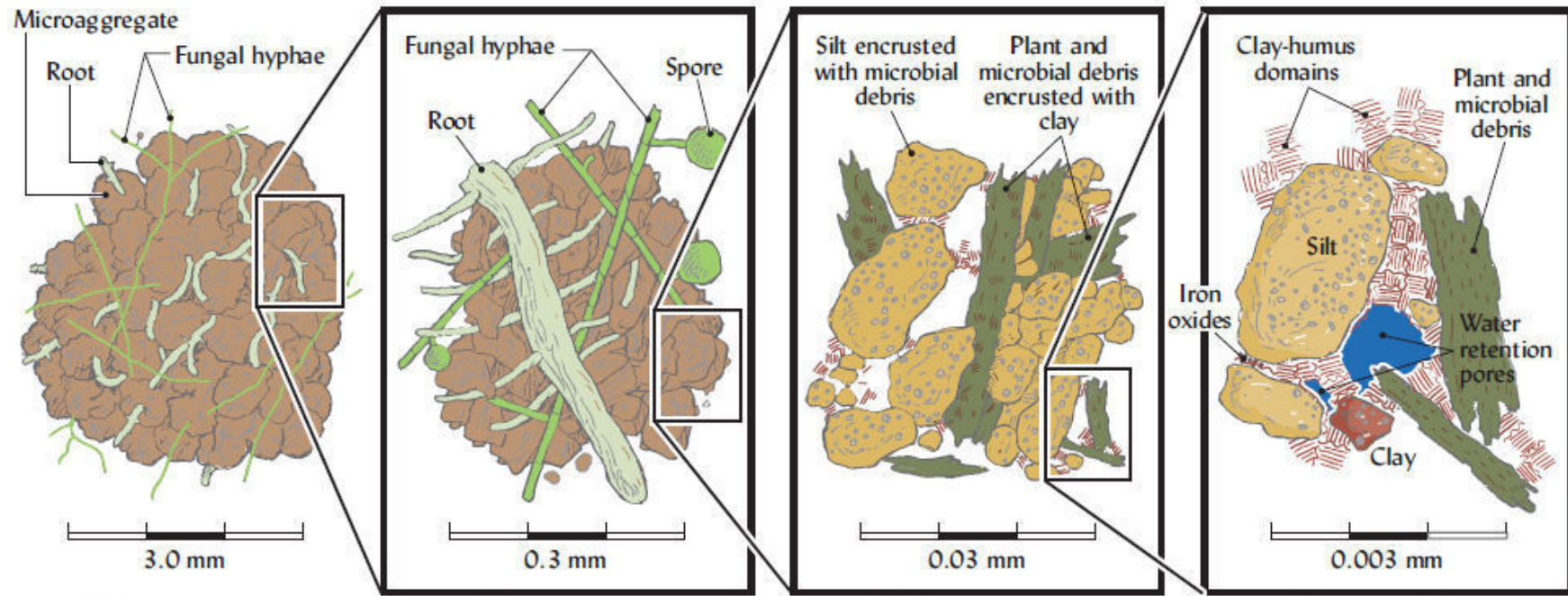
Hierarchical organization of soil aggregates

- Hierarchical organization of soil aggregates is the characteristic of most soils



- Even the smallest particles turns out to be 'aggregates' made up of numerous primary soil particles

Hierarchical organization of soil aggregates



Macroaggregate

- Roots
- Hyphae

Microaggregate

- Root hairs
- Hyphae
- Polysaccharides

Submicroaggregate

- Mineral grains encrusted with plant and microbial debris
- Plant debris coated with clay

Primary particles

- of silt, clay and humus
- Clay and clay-humus domains

Grade of soil structure

- The terms weak, moderate, or strong are used to describe the grade or how stable the peds are and how hard they are to break apart

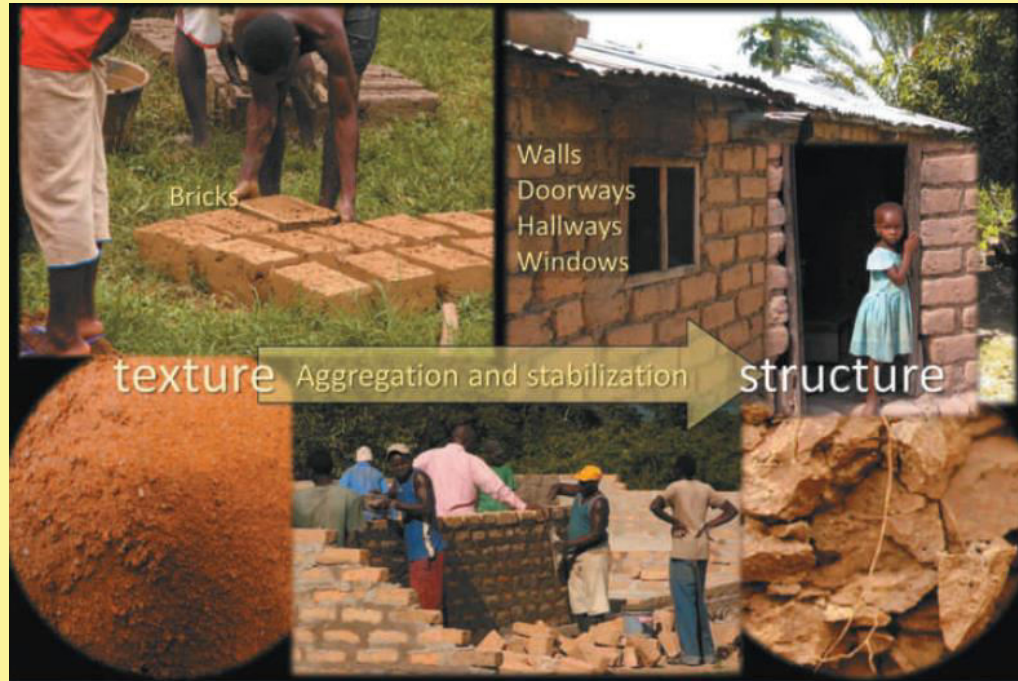


http://soils.usda.gov/technical/manual/images/fig3-27_large.jpg

Soil texture and structure

Texture – size of bricks used

Structure – arrangement of bricks



- ❑ House represents **soil structure**
- ❑ Halls, doorways and windows in the house represents associated **pores and channels**