

SOIL STRUCTURE

6th semester(Hons.) Paper DSE 4

Department of Geography

Mankar College

Presented by

Dr. Srabanti Ghosh, Assistant Professor

Session: 2019-2020

Definition

- *Soil structure* is the aggregation of the primary soil particles (sand, silt, and clay) into compound particles which are separated from the adjoining aggregates by the surface of weakner.

Soil Structure

- Soil structure is the way in which the individual particles (sand, silt, and clay) are arranged into larger distinct aggregates.
- Soil aggregates are groups of soil particles that bind together more strongly than to neighboring particles
- Aggregate stability refers to the ability of soil aggregates to avoid disintegration when disturbed by tillage or erosion.

Factors that affect

Aggregate Stability

- Amount of clay
- Chemical elements
- Organic matter
- Biological activity

Soil Structure

- Organic matter
- Soil organisms
- Tillage
- Freezing and thawing
- Water movement
- clay colloid
- iron and aluminium hydroxide

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.

Organic Matter Content

May be increased by

- Adding manure
- Growing cover crops



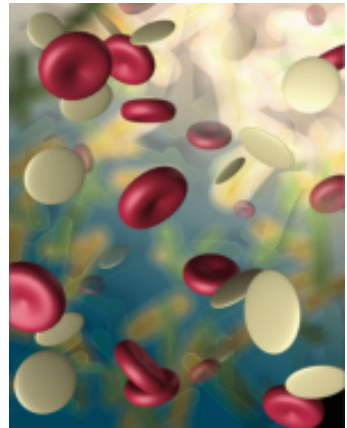
May be decreased by

- Tillage
- Hot,
Humid
environment



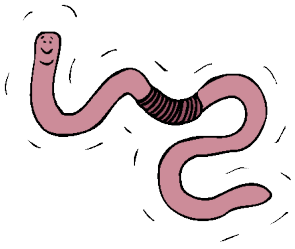
Soil Organisms

- **Bacteria** in soil have sticky substance on cell wall.
- This “glue” holds soil particles to bacteria and to each other.
- This binds soil particles into larger particles.
- **Fungi** produce thread-like structures called mycelia which bind soil particles and peds making larger particles.

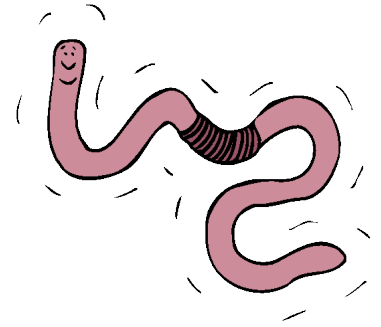


Soil Colloids

- Very small particles with a weak electric charge. + o o-
- The charge causes water to bind to particles.
- As water evaporates, colloids and larger particles draw together, creating even larger particles.



Tillage



Positive effect

- Creates air space in soil, allowing organisms needed oxygen

Negative effect

- Disrupts the soil structure and kills the larger organisms such as earthworms.
- If done when too wet or dry, may destroy the soil structure of the tillage zone.

Freezing and Thawing

- As water in soil freezes it expands, pushing soil particles apart.
- This opens pore spaces for air.
- As water thaws, pore spaces tend to remain temporarily.
- This can be enough to encourage soil organisms, by allowing more oxygen.

Water Movement

Positive Effect:

- As water moves vertically through the soil some of the water is stored, and can be used by crops.

Negative Effect:

- Vertical movement of water can cause leaching of minerals.
- Vertical movement in soil freshly tilled may cause collapse and less pore space.
- Vertical movement in clay can result in a hard pan.
- Horizontal movement may cause erosion.

Describing Soil Structure

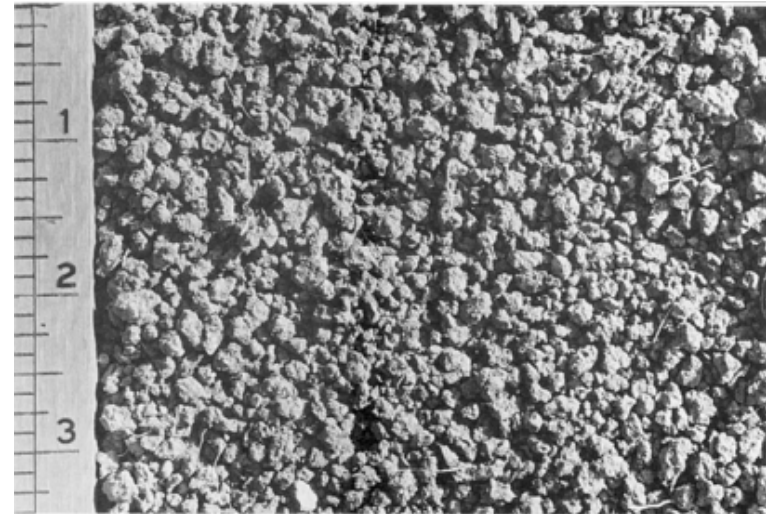
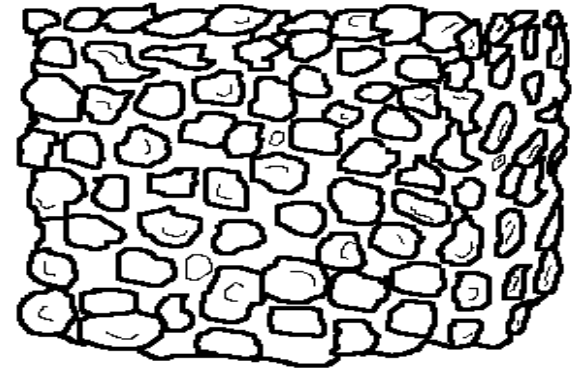
- Type – shape of the structure
- Size – relative size of the structure
- Grade – how well the structure is expressed in place.

Ped Shapes

- Granular
- Blocky
- Prismatic
- Columnar
- Platy
- Single-grained
- Massive

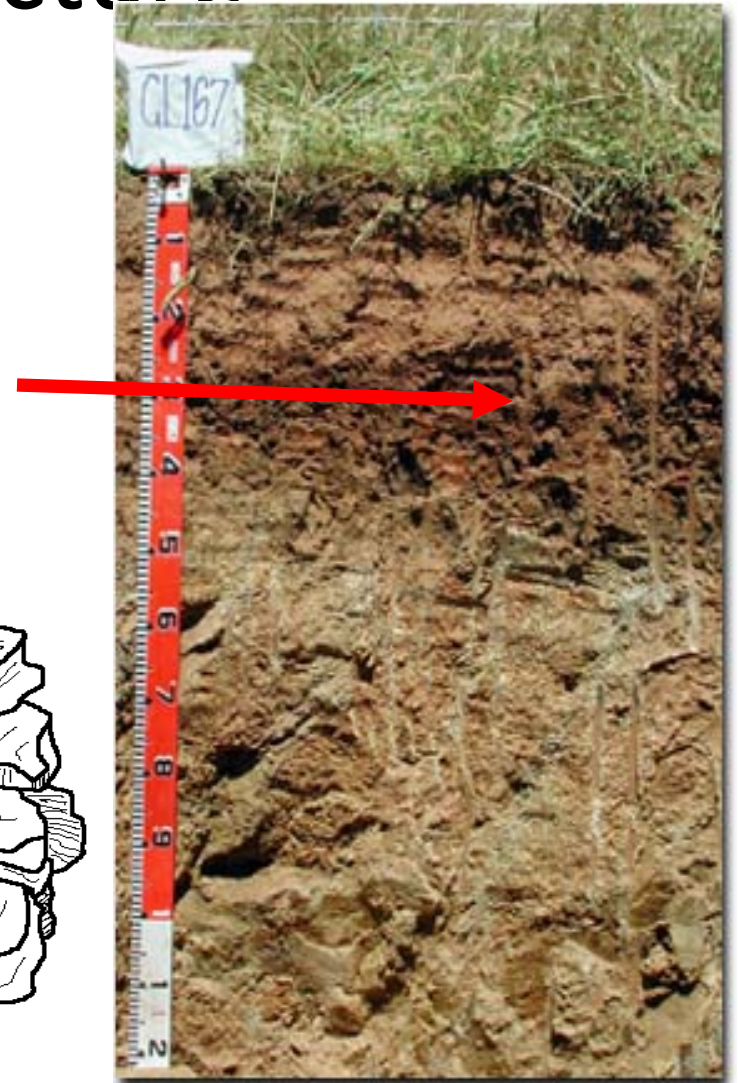
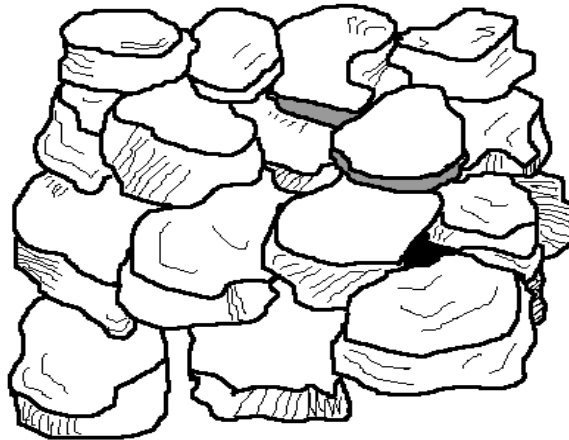
Granular Structure

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



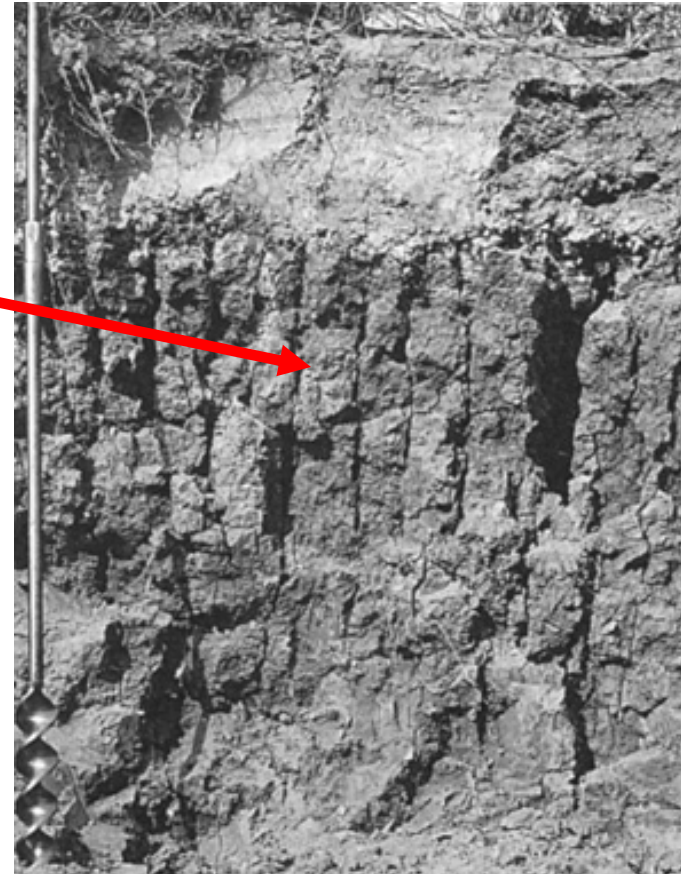
Blocky Structure

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



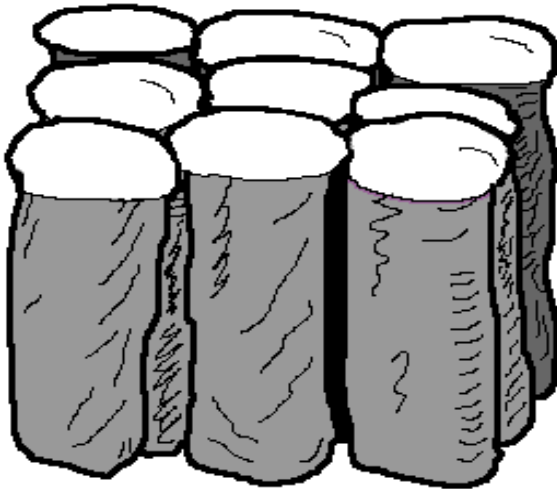
Prismatic Structure

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



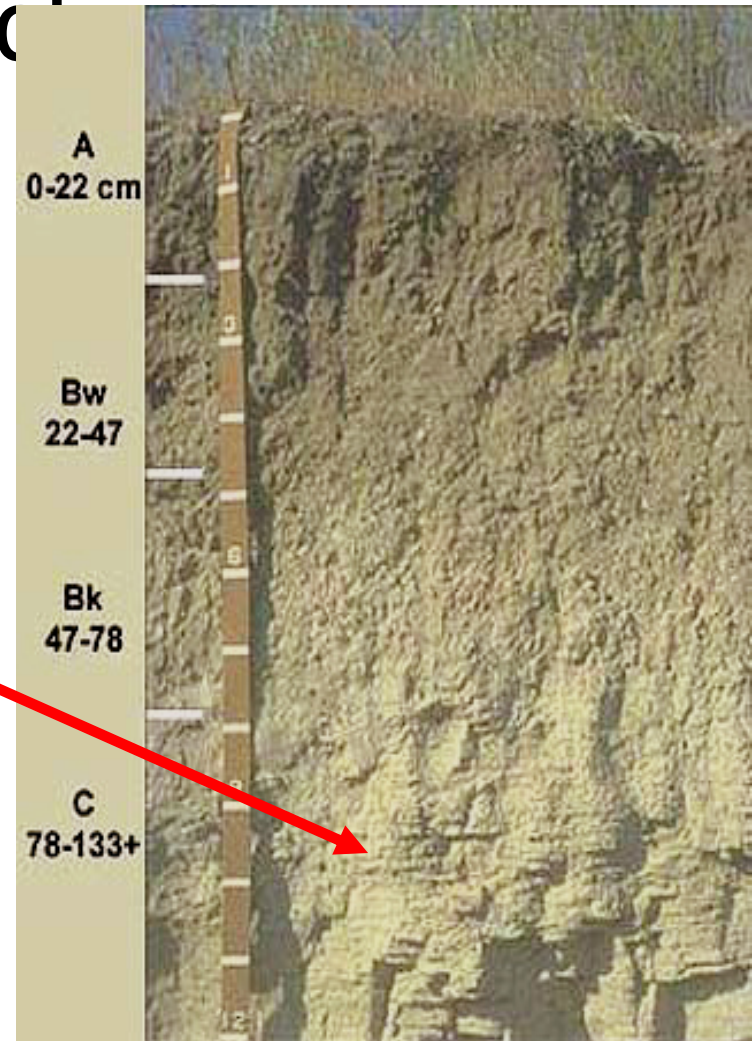
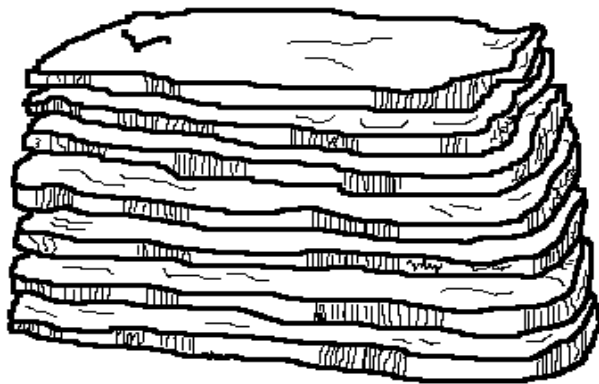
Columnar Structure

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



Platy Structure

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



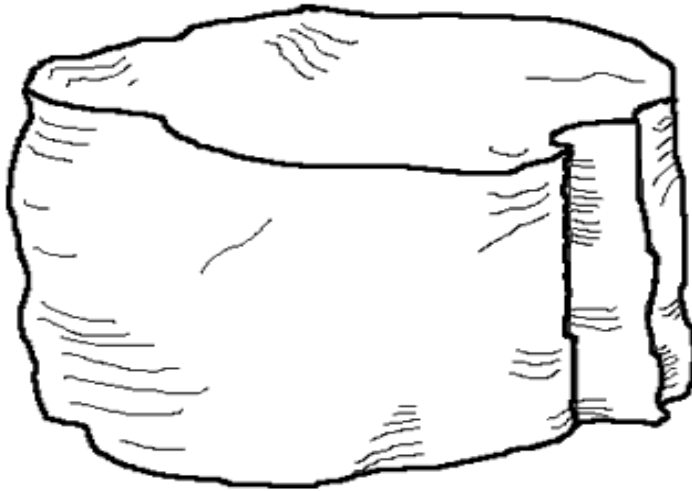
Single-grained Structure

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



Massive Structure

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



Classes of structure

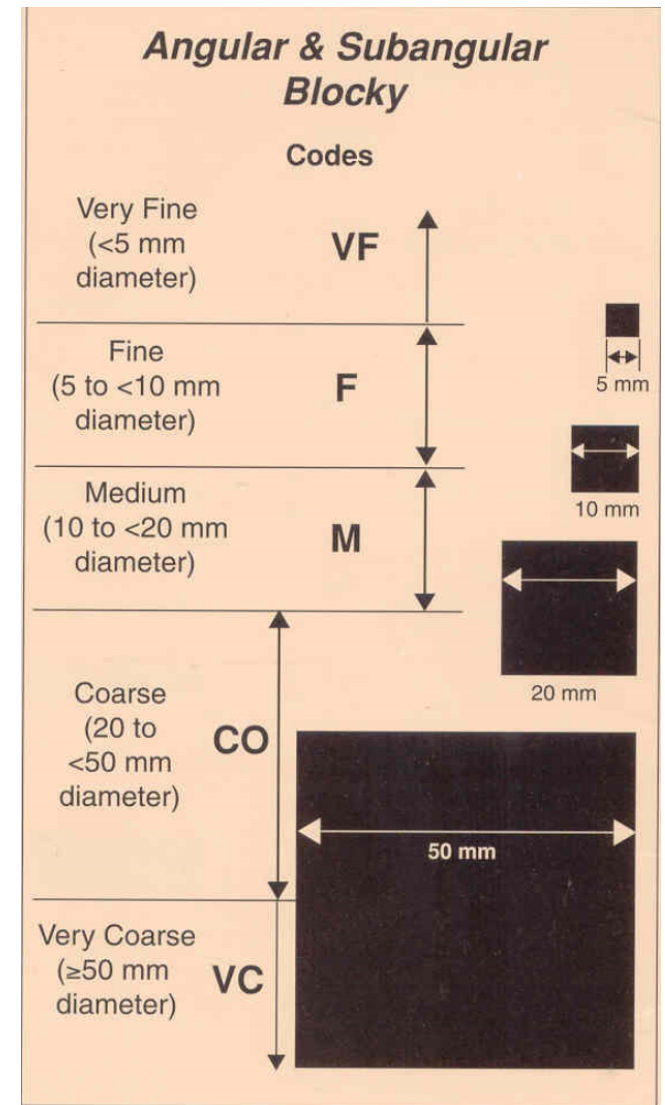
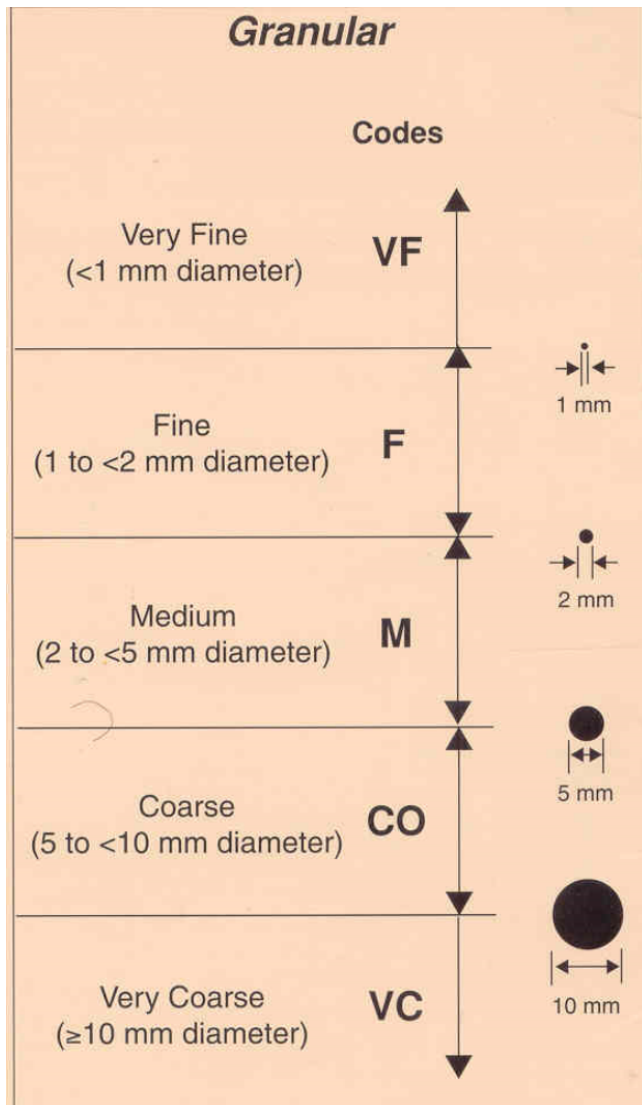
Each primary structural type of soils is differentiated into 5- size classes depending upon the size of the individual peds. The terms commonly used for the size classes are:

- 1) Very fine or very thin
- 2) Fine or thin
- 3) Medium
- 4) Coarse or thick
- 5) Very coarse or very thick.

The term thin and thick used for platy and while the term fine and coarse for others.

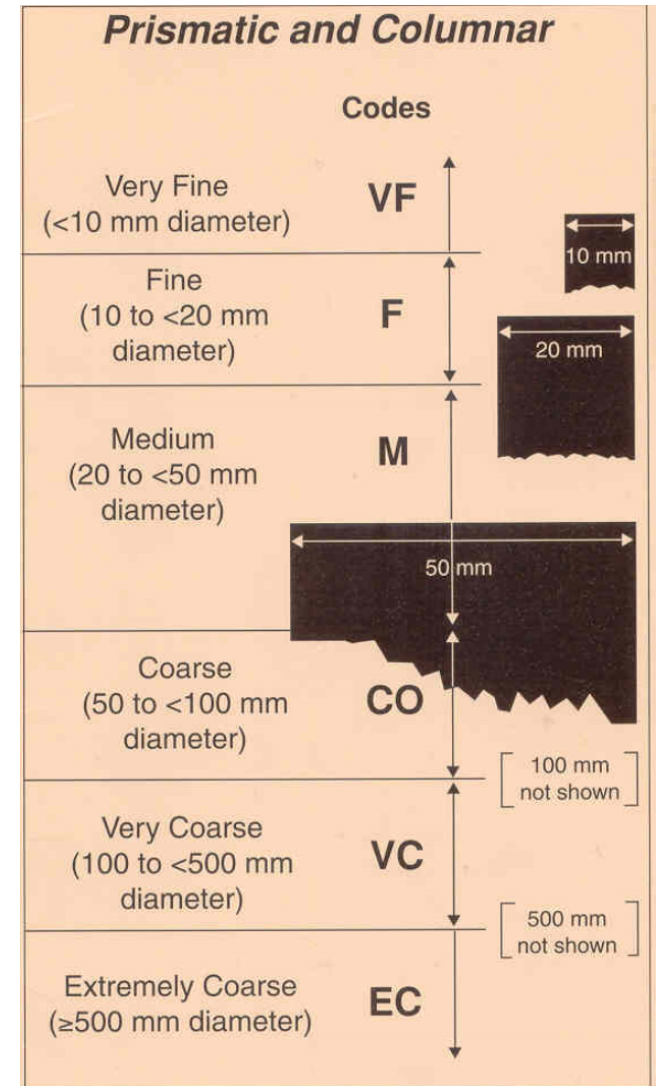
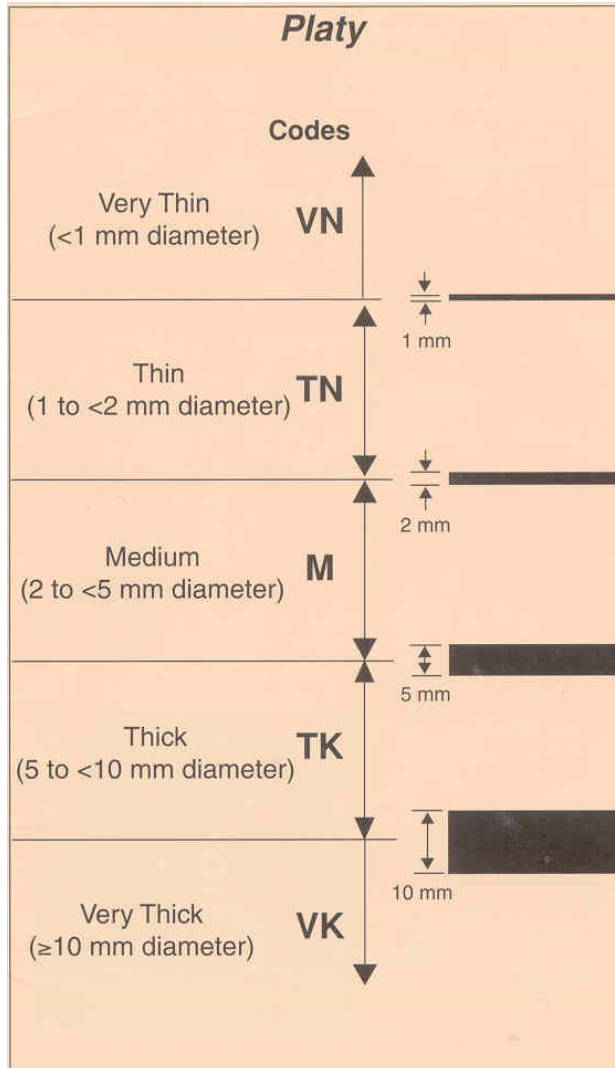
Soil Structure Size (Granular and Blocky)

Image Source:
NRCS, Ver. 2.0, 2002



Soil Structure Size (Platy and Prismatic)

Image Source:
NRCS, Ver. 2.0, 2002



Soil Structure Grade

- Structureless = 0
 - Single Grain (non-coherent)
 - Massive (coherent)
 - Massive - Rock Controlled Fabric
- Weak = 1
- Moderate = 2
- Strong = 3

Grade of structure

- Grade indicate the degree of distinctness of individual peds.
- It is determined by the stability of aggregates.
- It is influence by moisture content of soil .
- It also depend on O.M, texture etc. four term used to describe the grade of soil structure are.

❑ ***Structure less.*** There are no noticeable peds .e.g. loose sand.

❑ **Weak structure.** Indistinct formation of ped, which is not durable.

- ❑ **Moderate structure:** moderately well developed peds ,which are fairly distinct.
- ❑ **Strong structure :**very well formed peds which are quite durable and distinct

Compound structure:

Smaller structural units may be held together to form larger units called compound structure.

- Naming of soil structure the sequence followed is grade, class and type. E.g. strong coarse angular blocky.
- moderate very coarse granular.

Description of Structure

- Three class of grade (Excluding Structureless (0)):
 - 1) Weak (1)– the units are barely observable in place and when gently disturbed, the soil parts into a mixture of whole and broken units.
 - 2) Moderate (2) – The units are well formed and evident in undisturbed soil. When disturbed, the soil material parts into a mixture of whole with some broken units.
 - 3) Strong (3) – The units are distinct in undisturbed soil. They separate cleanly when the soil is disturbed and when removed the soil separates into whole units.

INFLUENCE OF SOIL STRUCTURE

- ❖ Controls water and air in the soil
- ❖ Plants need nutrients which is available through sufficient water. Plant root and germination need sufficient air.
- ❖ Bacterial activity depends on water and air.
- ❖ Optimum air water nutrient relationship depend on structure.
- ❖ Determine amount of runoff and erosion.