The soil building blocks

https://www.vaderstad.com/se/know-how/grunderna-i-agronomi/grundlaggande-fakta-om-jord/jordens-byggstenar/

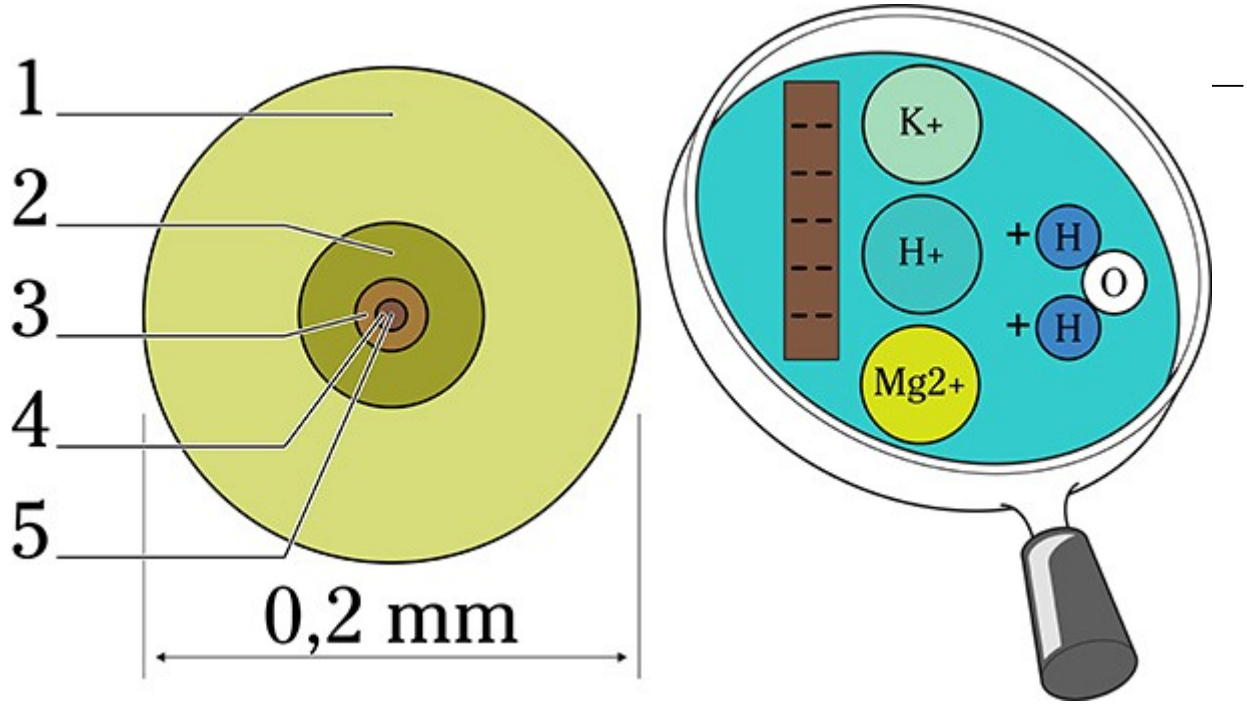
The soil we process into a seedbed is only half solids while the rest are cavities filled with water or air. Of the solid material, clay and organic material are the ones that make the strongest mark on the earth and determine the use properties. The earth's building blocks consist of about 50% of solid material and about 50% of pores in between. Simply put, half of a lump of earth is solid material while the other half is voids (interstitia).

Pores with water or air

The solid material consists of either mineral particles of different size classes or of organic material. The important pores are filled either with air or with water depending on how moist the soil is at the moment, its structure and the processing (manual or with tools) of the soil. Ideally, half of the pores are filled with water and half with air. In soils with a uniform structure such as clay, however, the pore volume is slightly higher (40–60%) than in single-grain soils such as a sandy soil (35–45%).

Grain size in classes

The texture of the soil refers to the mineral particles divided into different size classes. Different countries use different classes, but a common internationally acceptable division classifies the texture into blocks, stones, gravel, sand, silt and clay according to the grain group division in the table "Grain group division" below. The figure shows the difference in size between some of the mineral particles in a soil and what significance this has. **The clay and humus particles** are the smallest constituents in the soil. Their average diameter is less than 0.0002 mm (i.e. 1000 times smaller than a grain of sand) and they are called colloids. The surfaces of the clay particles are negatively electrically charged. This means that positively charged nutrients such as Potassium, calcium and magnesium ions can bind to the clay particles. Thus, the clay particles constitute a nutrient store for the plants.



1)Fine sand **2)** Very fine sand **3)** Coarse silt **4)** Fine silt **5)** Coarse clay

Silt holds water

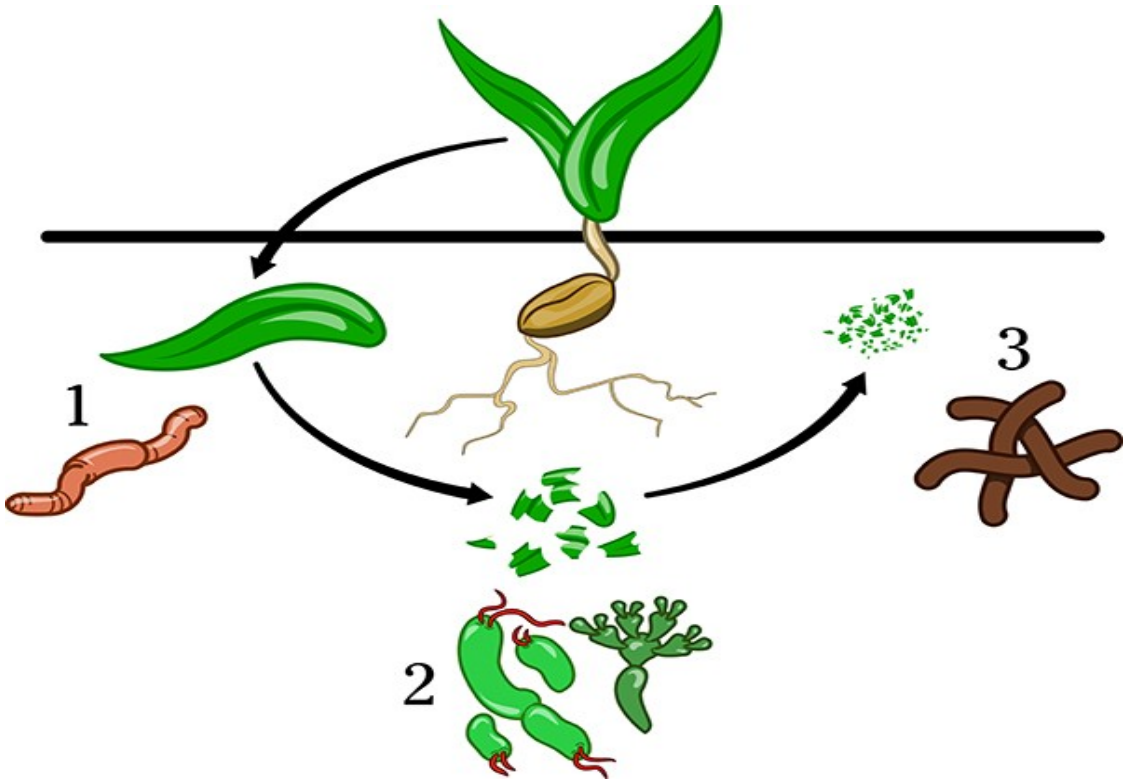
A cultivated arable land is often a mixture of several different grain size groups. If gravel and sand dominate the soil, it gives permeable, dry and lean soils, while a mixture of sand in a clay soil makes it warmer. Silt soils are often cold and water-retaining and easily absorb water through capillary rise. The finest mineral particle clay already sets a strong mark on the soil at concentrations of around 5 percent. Clay soils shrink and swell and give an aggregate structure to the soil with cracks and cavities where roots can grow through the soil profile. The typical properties of the different soils are often a function of the clay content that strongly shapes the soil type and its use.

Organic material is positive

The organic material in the soil also makes its mark on the character of the soil very clearly. It consists of almost 60 percent carbon (C) and consists of plant residues that are broken down by microorganisms. In this decomposition process (see picture below) plant nutrients are released such as nitrogen (N), phosphorus (P) and sulfur (S). The organic material is extremely important for the properties of the soil and the influence is almost always positive from the grower's point of view. It affects, for example:

- Structure and unit stability
- Water management
- Tillage
- The food supply
- Sludge and crust

The



degradation process

1. *The terrestrial animals* start the decomposition of the dead organic material, partly by decomposing into smaller pieces, partly by digging holes in the soil so that the oxygen

supply increases. Earthworms play a special and very valuable role, by breaking down the material and mixing it into the soil.

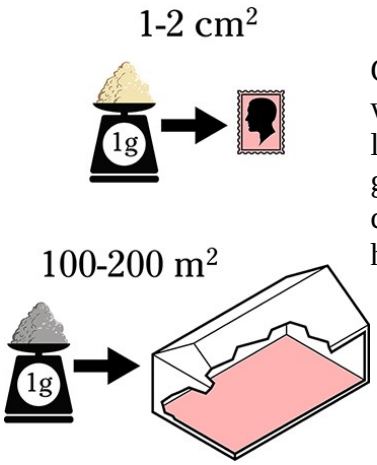
2. *Bacteria and fungi* continue to degrade gradually. The last phase where the simple end products available to the plants (eg nitrate, phosphate and sulphate) are formed is called mineralization.
3. *Humus formation*. The decomposition of the various organic substances takes place over a series of intermediate products which, during the decomposition process, become of an ever simpler kind. These intermediates react with each other and with substances created by soil organisms. In this way, new chemical compounds are formed that turn into high-molecular, dark-colored substances called humic substances. These humic substances have the ability to bind positively charged ions of e.g. potassium, calcium and magnesium.

The smallest of the ground has a large surface area

Both the fine clay (<0.0002 mm) and part of the organic material are colloids and constitute the smallest constituents in the soil. At the same time, they have a large specific surface area, i.e. a large surface area in relation to their weight. The specific surface area increases with decreasing grain size (see table "Grain group division" below). The surface of the clay particles is negatively (-) charged so that nutrients in the soil such as cations (+) can bind to the surface and thus constitute a supply of nutrients for the plants.

Grain group division

Grain group	Grain size diameter (mm)
Clay	<0.002
Silt	0.002-0.06
Sand	0.06-2
Gravel	2-60
Stone	60-600
Block	> 600



Characteristic of all clay minerals is their flat shape. This, together with their extremely small size, means that clay colloids have a very large surface area in relation to their mass - a high specific gravity. One gram of sand, for example, has a total area of about 1.5–2 cm2, which corresponds to a small stamp. A gram of clay, on the other hand, can have a total area of several 100 m2 - a medium-sized dwelling house.

Glossary:

Pores = soil pores refers to the cavities, channels and cracks that are either filled with water or air depending on the current water content of the soil

Mineral particles = soil mineral particles are the inorganic smallest constituents that have formed in the field through weathering of various minerals and rocks or have been transported there by e.g. inland ice. The properties of a soil depend a lot on the size of the mineral particles according to the table "Grain group division" above

Texture = the texture of the soil refers to the proportions of mineral particles with different average diameters, i.e. which is the size ratio between mainly sand, silt and clay according to table "Grain group division"

Capillary = capillary water refers to the water that can rise in the fine pores of the soil by the water molecules being bound to the mineral particles in the pore by so-called adhesion but also by the water molecules attracting each other through so-called cohesion. Silt soils are capillary and combine both high capillary rise in the pores with a high capillary rise rate

Colloid = colloids are the finest particles on earth with an average diameter below 0.0002 mm. The colloids include some organic material and fines

Specific area = the total area of the soil particles is given in square meters per g of dry soil and is an important character because it indicates how much nutrients the soil can release through weathering or bind to its surface

Cations = positively charged ions in the earth such as the plant nutrients potassium, calcium and magnesium

Ground animals = earthworms, gray sows, tails, millipedes, mites and other animals that open the door to bacteria and fungi by dividing and breaking up the plant remains in the mouth, stomach and intestines