

SOIL MINERALOGY

When the earth was forming, several different rocks were created. Inside of these rocks, there are a lot of different minerals. As these rocks break down, some of these minerals break down and form soils. Soils are originally from rocks, and their chemical and physical properties mimic these rocks. Because these minerals are small, they dominate the clay portion of soil. This characterization of soil minerals determine the soil chemical properties, and how fertile it will be.

How do rocks weather to create soil? How old is this soil? What is the crystal structure of the particles in soil? What different kind of soil clays are there? How do these clays impact chemical and fertility properties of the soil? These are a few example questions that a soil mineralogist would ask. Soil mineralogy is closely related to soil chemistry and fertility.

WHAT DO SOIL MINERALOGISTS STUDY?

Different Minerals and Clay Minerals in Soil

The mineral part of soil is made up of many types of minerals. A Primary mineral comes directly from rock: like pyrite (fools gold). A list of minerals and rocks can be found [here](#). These minerals break down into different types of clay minerals. View an animation of breakdown of primary minerals [here](#). All of these different types of materials have different abilities to hold onto different nutrients and chemicals.



Olivine



Biotite



Na-Plagioclase



Augite



Muscovite



K-Feldspar



Hornblende



Ca-Plagioclase

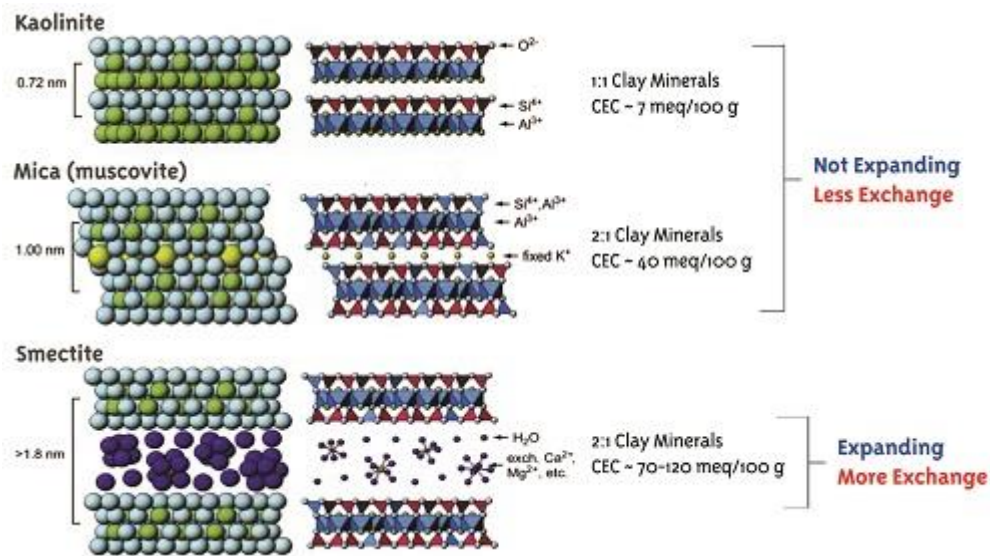


Quartz

An overview of different minerals found in soil

There are several different types of clay minerals that come from primary minerals. Clay minerals that are older and more weathered hold on to less nutrients. Some young soils are very active, and they materials that cause them to shrink and swell. These materials are high activity clays, and these soils have the ability to hold a lot of nutrients. In younger soils, the clay minerals are new. In well weathered soils, certain minerals, like Gibbsite, Hematite, and form of oxides. These oxides are the leftover metals from intense weathering, have a very low Cation Exchange Capacity and cannot hold many soil nutrients. To see a cycle of what nutrients are removed at what times, please click [here](#).

Soil crystalline Structure of different minerals



The clay minerals contain different building blocks. Some of them are tetrahedral, which is a pyramid shape polyhedron composed of four triangular faces, three of which meet at each vertex. These have Silicon in the middle, and four oxygens at each corner. These form in layer sheets with an octahedron, which has 8 different faces.

The different cations in octahedron is what makes each clay unique, and is surrounded by 6 different oxygen or hydroxide molecules. This sounds very complicated, but these different layers assemble together like layers of a cake, and determine very important properties of soils.

Weathering Processes

As the different types of minerals found in the soil weather, they change in composition. This changes a soils ability to hold onto water and nutrients. There are different types of **weathering**, both chemical and physical kinds. Chemical weathering occurs when chemical reactions (water is key), break down the rocks

and primary minerals into soil. This includes oxidation, which is responsible for a lot of the red colors in soils. Physical weathering breaks apart rocks without chemical reactions. Pounding a rock with a hammer is an example of this type of weathering. Physical weathering occurs more in dry areas.