THE GENESIS OF SOIL.

Soil primarily had its beginning from rock together with animal and vegetable decay, if you can imagine long stretches or periods of time when great rock masses were crumbling and breaking up. Heat, water action, and friction were largely responsible for this. By friction here is meant the rubbing and grinding of rock mass against rock mass. Think of the huge rocks, a perfect chaos of them, bumping, scraping, settling against one another. What would be the result? Well, I am sure you all could work that out. This is what happened: bits of rock were worn off, a great deal of heat was produced, pieces of rock were pressed together to form new rock masses, some portions becoming dissolved in water. Why, I myself, almost feel the stress and strain of it all. Can you?

Then, too, there were great changes in temperature. First everything was heated to a high temperature, then gradually became cool. Just think of the cracking, the crumbling, the upheavals, that such changes must have caused! You know some of the effects in winter of sudden freezes and thaws. But the little examples of bursting water pipes and broken pitchers are as nothing to what was happening in the world during those days. The water and the gases in the atmosphere helped along this crumbling work.

From all this action of rubbing, which action we call mechanical, it is easy enough to understand how sand was formed. This represents one of the great divisions of soil sandy soil. The sea shores are great masses of pure sand. If soil were nothing but broken rock masses then indeed it would be very poor and unproductive. But the early forms of animal and vegetable life decaying became a part of the rock mass and a better soil resulted. So the soils we speak of as sandy soils have mixed with the sand other matter, sometimes clay, sometimes vegetable matter or humus, and often animal waste.

Clay brings us right to another class of soils clayey soils. It happens that certain portions of rock masses became dissolved when water trickled over them and heat was plenty and abundant. This dissolution took place largely because there is in the air a certain gas called carbon dioxide or carbonic acid gas. This gas attacks and changes certain substances in rocks. Sometimes you see great rocks with portions sticking up looking as if they had been eaten away. Carbonic acid did this. It changed this eaten part into something else which we call clay. A change like this is not mechanical but chemical. The difference in the two kinds of change is just this: in the one case of sand, where a mechanical change went on, you still have just what you started with, save that the size of the mass is smaller. You started with a big rock, and ended with little particles of sand. But you had no different kind of rock in the end. Mechanical action might be illustrated with a piece of lump sugar. Let the sugar

represent a big mass of rock. Break up the sugar, and even the smallest bit is sugar. It is just so with the rock mass; but in the case of a chemical change you start with one thing and end with another. You started with a big mass of rock which had in it a portion that became changed by the acid acting on it. It ended in being an entirely different thing which we call clay. So in the case of chemical change a certain something is started with and in the end we have an entirely different thing. The clay soils are often called mud soils because of the amount of water used in their formation.

The third sort of soil which we farm people have to deal with is lime soil. Remember we are thinking of soils from the farm point of view. This soil of course ordinarily was formed from limestone. Just as soon as one thing is mentioned about which we know nothing, another comes up of which we are just as ignorant. And so a whole chain of questions follows. Now you are probably saying within yourselves, how was limestone first formed?

At one time ages ago the lower animal and plant forms picked from the water particles of lime. With the lime they formed skeletons or houses about themselves as protection from larger animals. Coral is representative of this class of skeleton-forming animal.

As the animal died the skeleton remained. Great masses of this living matter pressed all together, after ages, formed limestone. Some limestones are still in such shape that the shelly formation is still visible. Marble, another limestone, is somewhat crystalline in character. Another well-known limestone is chalk. Perhaps you'd like to know a way of always being able to tell limestone. Drop a little of this acid on some lime. See how it bubbles and fizzles. Then drop some on this chalk and on the marble, too. The same bubbling takes place. So lime must be in these three structures. One does not have to buy a special acid for this work, for even the household acids like vinegar will cause the same result.

Then these are the three types of soil with which the farmer has to deal, and which we wish to understand. For one may learn to know his garden soil by studying it, just as one learns a lesson by study.