Articles Left Over.

Lack of space compelled us to "lay over" several articles which should have appeared in this issue. They will be published in February.

Seed Grain!

During the last six months we have been collecting much valuable information concerning seed grain, corn and vegetables, the pith of which will be published in our February and March numbers. New varieties will be compared with the older and standard sorts; the varieties giving the best results in the different sections will be named. We invite intelligent and progressive farmers everywhere to write us, giving all the information they can on these subjects. We can collect a great deal of practical information, yet our readers can greatly assist us. On the first page we offer a prize of $5 for the best essay sent us on these subjects. We invite farmers to carefully read the rules governing these essays, especially No. 3.

Send Us Information.

Farmers everywhere are invited to write us on practical subjects pertaining to agriculture and live stock. To such as send us articles containing valuable matter we will pay at the rate of 10c. per inch, as explained in rule 3 governing the prize essays.

Criticisms of articles which have previously appeared, reports of experiments, particulars concerning new grains or vegetables, or new and useful farm implements, drawings of new devices, plans and descriptions of buildings, etc., etc.—all are welcome and will be duly paid for if valuable. The ADVOCATE is pre-eminently the farmers' paper. We are determined to make it the best and most useful agricultural journal published; we ask the farmers to assist us.

The Origin and Formation of Soil with Special Reference to Ontario.

BY J. HOYES PANTON, M. A., F. G. S.

(Continued from page 472.)

However, great changes were going on, and the surface of the province was considerably modified from the action of agents we shall now consider:

III. Disintegrating agents, i. e., agents breaking up rocks. These acted upon the solid floor of Ontario during vast periods of time.

1. Air, in the presence of moisture, has a great influence upon rocks, especially if iron is in them, and this is a common ingredient among the oldest rocks. You often notice by the wayside, boulders with rusty stains upon them. These result from the action of the air upon the iron in the stone. It will only be a matter of time before it is dissolved out and the stone crumbles to pieces. The element, oxygen, a constituent of air, has a great tendency to unite with other elements, and, hence, its destructive effects upon many rocks. Consequently, the simple action of the air in the long ages between the Devonian and Pleistocene periods would no doubt do much to the breaking up of the rocks upon which it acted.

2. Water, especially in the form of rain beating upon the rocks during this long period would exert a wonderful influence upon the rock surface in two ways, viz., mechanical and chemical. The former needs no explanation for it is readily seen how rain would act, as we see it to-day by distributing the ground-up rock and wearing away by mechanical action the surface over which it flowed. But there is another way in which it can act very forcibly, especially when it contains carbonic acid which is present in the atmosphere. When this carbonic acid and rain water come in contact with rocks, especially such as contain lime, magnesia and iron, they form with them compounds soluble in water, and thus break up the rock in which they are found. This solvent action of water explains why it is always more or less charged with mineral substances, producing so-called hard water. Many caves, especially those found in limestone, have been formed by the solvent action of water, and the beautiful icicle-like structures in them have been deposited from water, drop by drop. The Mammoth Cave of Kentucky has 223 avenues representing 150 miles. The average height and width of these passages is 21 feet. The amount of limestone removed is said to be equivalent to 12,000,000 cubic yards. This to a great extent is the result of the solvent action of water. Rain charged with carbonic acid during long ages would certainly act so as to disintegrate the limestone floor of Ontario. See its effects upon the marble tombstones in a graveyard, and observe how it corrodes the limestones of the field so that we readily distinguish them by their *weathered* look.

3. Plants as soon as they appeared would exert an influence upon the surface. While living the tender roots penetrating the soil would feed upon the minute particles and dissolve those near them, and when they died channels would be left for rain to pass into the soil, and the decomposing plants supply carbonic acid which would aid in the work of disintegration.

4. Animals, especially such as burrowed, would open up the way for air and rain to reach below. Few animals are credited with more influence in the breaking up of soil than the common earthworm. From extensive experiments by Darwin it has been discovered that in some places worms add one-fifth of an inch of mould yearly to the soil, or at the rate of 16 tons to the acre derived from the deposits they leave upon the surface. Besides this their burrows form passages for air and rain to act upon the rock material exposed.

5. Frost while it existed would be a powerful agent. We see how it breaks down the rocky banks of rivers and sculptures the mountains. Much of the rock lying at the base of mountains, cliffs and steep banks is the result of frost.

Now the more we dwell upon these five agents, *air*, *rain*, *plants*, *animals* and *frost*, the more we will be convinced of their disintegrating effect, especially when we think of the vast period of time elapsing from the close of the geological records (Devonian No. 6) in Ontario, until they were reopened for deposits in the Pleistocene days (No. 15). This gap, as already noticed, embraced eight periods, each of which may have been thousands of years in duration; yet in that time the rock surface was undergoing changes that must have prepared great deposits of finely divided rock. However, this soil would be largely localized, being much of the same nature as the rock below it; but when the Pleistocene period arrived, the Ice Age appeared, and was destined to mingle this pulverized rock in a most marvellous manner. In order to understand this more fully, let us examine some things going on now in countries where mountains are found with snow capped summits throughout the whole year, and from these phenomena form some conclusions regarding the state of affairs in Ontario during the Ice Age, claimed by some writers to have lasted 160,000 years.

IV. Ice Age, the period during which enormous quantities of rock material were ground up and mixed with soil formed previous to its appearance.

In countries where the mountains are high above the level of the sea, a line of perpetual snow is formed, and ice keeps accumulating throughout the whole year. In time the mass becomes so great that it can no longer remain upon the mountain top, but begins to descend. If the slope is steep, the descent is rapid, and the mass of ice is known as an *avalanche*, which moves with tremendous force into the valley below.

But if the descent is gradual, then the ice moves slowly towards the lower country, and forms an ice river (a *glacier*), sometimes miles long and hundreds of feet thick. It glides onward, sometimes at a slow rate—only a few inches each day—yet it moves, and what seems very remarkable, moves more rapidly in the centre than on the sides. This has been shown by putting stakes in the glacier and along the sides. In the course of time they assumed a V shape, indicating that those in the centre have made more progress than those at the side. In the course of its journey, fragments of rock are constantly falling upon the glacier. If cracks *(crevasses)* occur in the ice, which is quite a common thing, the rock drops into them and becomes imbedded in the ice. In cases where some reach the bottom one can readily understand what a grinding effect those imbedded rocks will have upon the rock below. Thus a glacier becomes a tremendous agent in grinding up rock. This river of ice will continue gliding on until it reaches a point at which the temperature is sufficient to melt it, and then it becomes the source of a river. If it is a very warm season, the glacier is not so long, and an opportunity is offered to see how things appear where the glacier was the season before. The solid rock is smoothed, polished and covered with markings running in the direction from which the glacier came, and the boulders lying about are rounded. Now if the glacier reaches the sea before it melts, a portion of it breaks off and moves away as an *iceberg*. This will carry away all the rock material in it, and all will be deposited where it finally melts. This is what occurs yearly along the coast of Labrador and Newfoundland, where so many bergs strand at certain seasons. Now, if an elevation of the sea bottom here took place, we would find it covered with great boulders, not the same as the rocks along the shore, but like those in Greenland, whence the icebergs came.