

SOME MINOR ERODING AGENCIES. By J. T. SCOVELL.

The major or more effective erosive agents are: Heat and cold, air and water, plants and animals, wind, flowing water and ice.

The roots of growing vegetation sometimes open fissures in soils and rocks so as to hasten erosion, but generally growing vegetation is conservative in its action, serving to hinder the work of erosion. But decaying vegetation, especially trees, often open the ground to the water, and frequently a gully has its beginning from rain-water entering the ground along the decomposing roots of some ancient forest tree.

Burrowing animals, as the ground hog and gopher, the badger and prairie-dog, rabbits, mice and crayfish, bring loose soil to the surface, where it can be scattered by the wind or washed away by the rain. Air and water, by means of these openings, penetrate the ground with their disintegrating powers, and the cause of erosion receives material aid. Again, the track of a mole breaks the surface, and is the beginning of a drainage channel whose extent is limited only by the amount of rainfall and the steepness of the slope. Smaller animals of lower groups are also important erosive agents.

Darwin mentions earth-worms, and calls attention to the immense amount of work they do in working over the soil, rendering it more porous and fertile, and opening it to the action of more active agents, as air and water.

Burrowing spiders do a similar work; they are not as numerous as the earth-worms, but their burrows are wider and generally deeper than those of the earth-worm, so that, with fewer numbers, they still do a great amount of erosive work. They are abundant everywhere, in yards and fields, between the bricks of walks and by the roadside. Frequently they build a little curb of sticks, bits of grass or other material, so that the burrow somewhat resembles a well.

Grasshoppers aid in erosion when they open the ground for their eggs. They do not form a very large or a very deep hole, but when their great numbers are considered, it soon appears that they are erosive agencies of no mean proportions.

The male cricket in some localities does a work that is quite similar to that of the garden mole, only on a smaller scale. An immense number of the coleoptera spend a large portion of their larval stage underground. The entrance to their burrows and the opening for their escape stirs up the ground to the action of air and rain. Thus these humble workers contribute their mite toward keeping the land on the run toward the sea. The numerous family of burrowing beetles and many others as adult insects aid in this work.

The larva of the cycadia of different kinds, during their long period of life under ground, must do much toward pulverizing the soil. The larva of some of the tipulidae, or crane flies, are among the most effective of these minor agencies. I found them last season working in shale and boulder clay. These materials were honey-combed to a depth of about three inches below the level of the water, and so well was the work done that the mass broke down easily in the fingers. The materials removed in boring their tubes was quickly dissolved or washed away, and penetrating the holes the water rapidly dissolved the partitions or so weakened them that even a gentle current carried away the shale and clay in great quantities.

Many different kinds of ants burrow in the ground often ranging over large areas. The amount of soil worked over each year by these little laborers must be very great. Then there are several kinds of wasps which work more or less extensively in the soil. Some of the bees also work in the ground, or in banks much like cliff swallows. They deposit their eggs at the bottom of a hole or burrow some two or three inches deep. Often they build out an entrance or porch to the hole, possibly as a protection against intruders. Their work breaks up large areas of material each season for the rains of spring and autumn to dissolve and carry away. Many other insects are engaged in this work, but the ones mentioned are perhaps the more important. These little fellows are among the minor agencies of erosion, but the amount of work accomplished each year is immense and can not be neglected in a careful study of erosion and erosive agents. In nearly every case the action of these little animals serves to enrich and fertilize the soil, thus promoting the growth of vegetation while aiding in erosion.

KETTLE HOLES NEAR LAKE MAXINKUCKEE. BY J. T. SCOVILLE.

Kettle holes are phenomena incident to the retreat of glacial ice. They are very numerous in southeastern Massachusetts and are abundant throughout the glaciated area wherever the ice halted long enough to form morainic deposits. They vary greatly in size, but are usually somewhat conical in shape. They are often occupied by water forming ponds or small lakes. There are said to be more than 300 such bodies of water in Plymouth Township, Massachusetts. In many cases, however, their walls are of sand or gravel, which do not retain water for any great length of time, so that they are usually dry. The holes are supposed to have been formed somewhat as follows: The clay, sand, gravel and other morainic materials along the margin of the ice were irregularly distributed so that in some places it was so thick as to protect the ice underneath from the