

MOSSES AS ROCK BUILDERS

W. H. Emig, 1917.

At the present time there is a continuous development of travertine on the numerous falls along two parallel streams of the Arbuckle mountains, namely, Honey Creek and Falls Creek. The evolution of this travertine involves a number of complicated processes which are better understood as one traces out the origin of the materials and the consecutive steps through which the materials are conveyed into their present form and position. The various types of travertine formed in the presence of felt-like masses of algae, species of *Oedogonium* and *Vaucleria*, and to aggregated turfs of the water masses *Philonotis calcarea* and *Didymodon topaceus* are quite characteristic. The similarity in the microscopic structure of recent and older deposits of travertine is

very striking. A comparison of the newly formed deposits with the oldest travertine of the Arbuckle mountains indicates that the same plant agencies were concerned in the construction of all the travertine formations.

A study of travertine as it is now developing in the Arbuckle region reveals many points of interest in regards to the origin of certain types of fossils and more particularly the fossil remains of plants. Fossils are naturally regarded by the geologists as records which enable him to determine the relative age of fossil-bearing rocks. But the botanist whose observations and researches do not extend beyond the limits of existing plants sees in the vast majority of fossil forms merely imperfect specimens which are impossible to determine with any degree of scientific accuracy. The remains of mosses in a fossil condition are exceedingly scanty. Nearly all of the moss forms discovered belong to the Tertiary and Quaternary periods and are closely allied or identical with living species. The mosses no doubt existed during the early geologic periods but the great delicacy of the tissues of most of them may account for their absence from the earlier geological formations.

Plants fossils frequently occur in the form of incrustations and in fact, incrustations which may assume a variety of forms are quite common. The action of calcareous water is well illustrated by the incrustation of plants and more particularly the water mosses that grow on the ledges of certain falls on Honey Creek and Falls Creek. The water moss *Didymodon*, which is restricted to calcareous habitats, grows in the form of dense tufts extending a fraction of an inch to four inches above the surface of the water. These moss tufts absorb water like a sponge and the calcareous water evaporates from the leaves and stems, carbon dioxide escapes and calcium carbonate deposits on the outer surfaces of the plants as a white crystalline covering. Naturally the older and submerged portions of the plants gradually decay. The incrustation increases and the resulting soft and brittle formation has very much the appearance of an aggregate of delicate corals. As this travertine becomes older, it hardens into a compact limestone. In photographs submitted with the original manuscript but not herein reproduced, two representative types of travertine are shown; type specimens of the oldest deposits of travertine. These rocks show two kinds of incrustations that were formed about water mosses as nuclei.

Travertine of the first type, develops about tufts of *Didymodon* growing erect on the surface of water falls. The gradual transitions

from living mosses to incrusted plants and finally to the compact limestone is a slow development. A second type of travertine, appearing in the form of small overlapping calcareous beds in three approximate rows for each moss stem,—arranged like the leaves of cedar or arbor vitae—is so different that one would suspect it to have been formed about mosses of another species. Such is not the case, but instead, the same species of mosses are incrusted with calcium carbonate but in a slightly different manner. If the mosses, instead of growing in erect tufts on the margin of the falls, grow in the more rapid water and appear on the lower ledges of the falls, the plants are more scattered and bend downward because of the water constantly passing over them. As the calcareous water evaporates, the incrustation slowly thickens about the leaves and stems, keeping pace with development of the plants to within one or two millimeters of the apex. The deposits about the leaves accumulate into little calcareous beads that are finally cemented into a soft mass of travertine. Photographs were made illustrating the gradual transition from living moss plant to soft cavernous limestone; a stone of a different appearance and formed in a slightly different manner from that of the first type. The plants of the same species of moss, however, serve as nuclei in the formation of both types of travertine.