ALGAL STALACTITES IN BERMUDA

By John W. Harshberger

The hills of Bermuda are formed of a friable limestone, which represents particles of calcareous sand, which in the early geologic history of this group of islands was drifted by the wind into elevated dunes and afterwards by water action was compacted into a harder, or a softer, lime rock. This native rock is sawed out of the hillsides and is used in the construction of house walls (large, thick blocks), or house roofs (large, thin slabs). When exposed to the air, this soft quarried rock hardens into a form of limestone, much like concrete in appearance. As in all limestone formations of any considerable thickness, caverns and underground tunnels are worn into the softer strata by the action of rain, and underground water. Several caverns of this character are visited by tourists in Bermuda and some of them have pools of salt-water replenished by underground supplies from the ocean. There are limestone sinks, which represent caves, the roofs of which have fallen in. A number of these sinks are dry, others are filled with water. One of the most frequently visited of these depressions, filled with saltwater, which comes underground from the ocean, is Devil's Hole in which are kept a number of the characteristic fishes of the Bermuda archipelago, such as, the grouper, the angel-fish, the red-snapper and others equally celebrated. The walls of the Devil's Hole are rather steep, and in places overhanging, so that the fresh water from the rocks above drips into the pool beneath. Here were found stalactites from an inch to two inches in length and coated with a covering of blue-green algae.

Several of these stalactites were broken off from the overhanging wall in Devil's Hole, June, 1905, and kept dry for subsequent study, but the material was overlooked until the present summer (1914), when a study was made of it. Small pieces of stalactite were crushed in water and examined under the microscope. The blue-green algae, which alone were present, were identified with Josephine Tilden's* first volume of Minnesota Algae. The algae

* Tilden, Josephine. Minnesota Algae. Volume I. The Myxophyceae of North America and Adjacent Regions, including Central America, Greenland, Bermuda, the West Indies and Hawaii. Bot. Ser. VIII, 1910.

found on this examination consisted of *Chrootheca Richteriana* Hansg., *Gleocapsa aeruginosa* (Carmichael) Kuetzing, *G. gelatinosa* Kuetzing, *G. quarternata* (Brébisson) Kuetzing and *Gleotheca linearis* Naegeli. Attached to a small red alga (not identifiable) which was fastened to a piece of stalactite was found *Microcystis flos-aqua* (Wittrock) Kirchner. The most abundant blue-green alga was *Chrootheca Richteriana* Hansg., which, according to Josephine Tilden, consists of a somewhat gelatinous plant mass, thick, or more or less expanded of a blue-green, or yellowish color. The cells found in these masses are 18–24 microns in diameter, once to twice as long as wide, single, or in pairs, with thick sheaths up to 6 microns in diameter. This species, figured by Miss Tilden, has been reported from Bermuda by Farlow and from Montego Bay, Jamaica, by Pease and Butler. Of the three species of *Gleocapsa* enumerated above, the following is the distribution recorded in the Minnesota Algæ:

G. aeruginosa Greenland, New York, West Indies (Porto Rico).

G. gelatinosa United States, West Indies.

G. quarternata West Indies, Hawaii.

The note with reference to *G. aeraginosa* in Minnesota Algae is apropos: "West Indies. Forming a dark green layer on stone in cave. 'El Convento,' near Penuelas, Porto Rico (Sintenis)" *Gleocapsa quarternata* is described as forming a gray-green, mucilaginous coating on wet cliffs in Hawaii. The distribution of *Gleotheca linearis* is given in Minnesota Algae, as: "West Indies. On damp walls of dam, Sharp's River, St. Vincent (Elliott)."

That these algae are active in the formation of the stalactites is indicated by their close attachment to the surface of the stalactites in the Devil's Hole, Bermuda. They remove in the case of the carbonated waters, containing calcium bicarbonate $(CaHCO_3)_2$ in solution, the gaseous carbon dioxide, which is used by the blue-green algae in photosynthesis of organic compounds, so that the stalactites are formed by the continual deposit of calcium carbonate ($CaCO_3$). Josephine Tilden has studied the formation of algal stalactites in the Yellowstone National Park, where such algae as *Gleocapsa violacea*, *Phormidium* (*Leptothrix*) *laminosum*, *Schizothrix calcicola* and *Synecococcus*

aeruginosus are active. Associated with the older part of the Bermuda stalactites, I found a small gasteropod mollusc, (*Kaliella turbinata* Gulick), hid away in small holes, or irregularities of their surface. In conclusion, we find by the study of the material from Bermuda, that other algae are concerned in the formation of stalactites besides those described from Yellowstone Park, and if a comparative study were made of stalactitic material from all parts of the world, the writer has no doubt that the list of algae concerned would be a respectable one.

ON ERIGERON PUSILLUS NUTT.

By N. L. Britton

I was much interested in reading Dr. B. L. Robinson's remarks on this species published in *Rhodora* for December, 1913, and, especially, because it was the study of specimens from Bermuda which enabled him to recognize the difference between this species and *E. canadensis* L. During a visit to Bermuda in late May and early June of this year, in company with Mr. Stewardson Brown, we studied these plants in the field, and our observations led us to agree with Dr. Robinson in ability to recognize the two species without any difficulty whatever, Mr. Brown having previously had similar experience in southern New Jersey. From the standpoint of the Bermuda flora, my interest in this plant was again increased because Mr. Oswald A. Reade, in his "Plants of Bermuda," published in 1883, had recorded both *canadensis* and *pusillus* from these islands, although not very well expressing the characters of *pusillus*, which he regarded as a dwarf state of *canadensis;* the purple-tipped involucral bracts, first observed by Dr. Robinson and cited by him as the salient character, are constant in Bermuda and, apparently, throughout the range of the plant in the eastern United States, as also the glabrate feature, entire leaves and smaller size of *E. pusillus*. In Bermuda, the two plants grow side by side in fields and along roadsides, and in some localities, at least, are equally abundant. Intermediate stations between Rhode Island and South Carolina are Bayshore, Long Island (*John McCallum*), Belmar, Monmouth County,