ical classification, a Hessose and the closely related Bandose and Auvergnose are the most widely represented types.

2. The table of mineral analyses shows the degree of purity of the material found and needs little explanation. Several of the occurrences are here recorded for the first time, notably the datolite. Laumontite furnished material for a crystallographic study now in progress. The angles observed between the simple prisms and oblique terminations are too far from those recorded to be easily explained by the impurity of the mineral. Further, an alteration of laumontite is found clearly formed at a dump of a new deep shaft on Snake River. Coarse red laumontite grades into light earthy green, especially along contacts of two crystals or the coating of calcite which is common on laumontite. Well-developed pseudomorphs occur, retaining the peculiar angles mentioned for the original. A study of occurrence on the dump, indicated that further alteration yielded a much lighter green soapy to earthy product. Thin sections show a confused aggregate, even in the pseudomorphs, none of the particles reaching one hundredth of a millimeter in length, and none showing a high interference color. The analyses show that these are no simple minerals, but they represent a remarkable substitution in the laumontite. Lime is completely removed, as is part of the water, while potassium and magnesium increase. The variability in similar material in other outcrops is also shown. Tests are in progress to determine its homogeneity if possible. It is proposed to call it pseudo-laumontite. A mottled diabase, altered very green, gave further evidence of the prevalence of alteration to some mineral or mixture high in potash and magnesia. Unless this soft aggregate contains orthoclase, the alteration is not previously recorded for laumontite. The solubility in sulphuric acid makes orthoclase quite impossible. Dana mentions alteration by "magnesian solutions." Van Hise[3] and Clarke[4] in discussing the alteration of rock minerals mention no such products, but Pumpelly[5] speaks of a replacement of many zeolites by chlorite, and a pseudomorph of "clay (?) after laumontite" which probably refer to similar material as it is common throughout the Keweenawan. Neither chlorite nor clay is an accurate name.

3. A study of the prospective copper deposits of the southwestern extreme of the Keweenawan rocks led to a test of the country rock for traces of copper. The common theory of origin of the Lake Superior copper deposits is that of lateral secretion from the diabases, but both ascending and descending solutions have been credited as supplying part or all of the copper. Direct evidence has not been found in the literature, except a reference to a few grains of sulphids in the fresh diabase. The present tests are reasonably conclusive. Copper does occur in all the main types of rock, and as far as can be judged from ten samples, *the fresher the rock the larger the amount of copper.* The type of rock shows less effect on the proportion of copper than the alteration. An olivine rock, high in the series on Snake River, with hardly alteration enough to yield chlorite, gave a maximum, 0.029 per cent., and the altered rocks a minimum, 0.012 per cent. Blank analyses were made and all due precautions observed. A test of the compound in which copper exists gives signs of an insoluble silicate, probably augite. Only one tenth of the copper was soluble in nitric acid in the rocks tested. A calculation shows that a concentration of copper from 500 parts of rock to one part of ore must have occurred to produce the known ores from such rock. Such a concentration, though extreme, is by no means impossible.

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UNIVERSITY OF MINNESOTA,
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[3] U. S. Geological Survey, Monograph 47.

[4] U. S. Geological Survey, Bulletin 330.

[5] Michigan Geological Survey, Vol. I., Pt. II., p. 45.

THE TOADS OF THE NORTHEASTERN UNITED STATES

SINCE the publication of the "Frog Book" by Miss Mary C. Dickerson, in 1906, consid-

erable interest has been aroused in the toads of the eastern United States. Mr. A. H. Allard, in two articles in Science, September 20, 1907, and November 6, 1908, has shown that, instead of being a very local race, as was supposed until quite recently, Fowler's toad is a widely distributed species found from northern Georgia to southern New England. During the past four summers the writers have been collecting and studying toads in the state of New Jersey and neighboring regions, and now feel able to make some statement as to the range of *Bufo americanus* and *B. fowleri* in that area.

At the outset of our investigations it was found that only one species, readily identified as Fowler's toad, occurred about our homes at Plainfield, N. J., and Staten Island, N. Y., as well as in the pine barrens of southern New Jersey. Later *Bufo americanus* was taken in Sullivan Co., N. Y., and afterwards by Mr. W. T. Davis in the mountains of northern New Jersey, where we have since found both Fowler's toad and the "American" toad living together, as they do in southern New England.

The characters which distinguish the two species are more apparent in living than in preserved examples, and are subject to considerable variation. The best difference is the relative wartiness of the skin, *Bufo americanus* being very much rougher, having much larger and more prominent warts on its dorsal surface, and especially on the hind legs, than *Bufo fowleri*. The presence or absence of spots on the breast is not an absolutely reliable guide, for we have found occasional specimens of Fowler's toads with a few faint spots, in addition to the usual median mark between the throat and breast; and examples of the American toad, with immaculate underparts are not uncommon. The general color of the belly of *B. fowleri* is grayish white, while that of *B. americanus* is a much buffier shade. The back of the former is ordinarily grayish, and that of the latter greenish or brown, often yellowish-olive or reddish. The American toad seems to attain a greater size than Fowler's toad, the head and body of a female specimen collected by Mr. Dwight Franklin in Pike County, Pa., measuring 10 centimeters in length. The iris of *Bufo americanus* is bronze in color, and that of *B. fowleri* silvery. It is our opinion that live Fowler toads have a much stronger odor, like that of ailanthus wood, than do American toads.

In the "Frog Book" Miss Dickerson states that *Bufo fowleri* has longer and slenderer legs. Our measurements show no appreciable average difference in the length of the legs, so that the apparent shortness of the American toads' legs is evidently due to their greater fleshiness, and more extensive webs.

While we do not agree with Mr. Allard in calling the song of Fowler's toad a "scream" or "wail," it certainly has much less music to it than the trill of the American toad. The notes are more closely connected, so that a sort of buzzing is produced.

The range of Fowler's toad has already been outlined by Mr. Allard as extending from New England to northern Georgia. It is found throughout the whole state of New Jersey, except possibly in the extreme northwest corner. South and east, it replaces *B. americanus* entirely, so that throughout southern and central New Jersey, as well as on Staten Island, there is only one kind of toad. All the toads we have been able to procure on Long Island have also belonged to the southern species, so that the American toad is probably not found there.

Bufo americanus is found together with *B. fowleri* in the mountainous portion of the state, and down the Palisades of the Hudson at least as far as Grantwood, opposite the upper part of Manhattan Island. We have a considerable series of examples collected at Newton, Newfoundland, Budd's Lake, Englewood and Grantwood. This toad is also found in numbers at Van Cortlandt Park, in the Borough of the Bronx, New York City, but we have found no typical examples, as yet, on Manhattan Island. Like many other northern animals, it extends its range down the Alleghenies, as is shown by two specimens sent to

us from Garret County, Maryland. In northern New Jersey, where both species of toad occur, the American toad is conspicuous only during the breeding season. In midsummer almost all the toads that are found hopping along the roadside at dusk are Fowler's toads. This apparent scarcity of the northern toad may be due to its habits; it may stay more in the woods, or come out later at night.

At Newton, N. J., in mid-June, a number of fine specimens of *americanus* were found in the long grass of a moist meadow bordering a cat-tail marsh, associated with pickerel and leopard frogs. No individuals of *fowleri* were found in the meadow, all, with one exception, being seen along the roads in the evening, where also a few examples of *americanus* were taken.

The difference in the time of breeding of the toads is well known. On Staten Island the song of Fowler's toad is first heard about April 20, when the American toads at Van Cortlandt Park, N. Y., have already begun to leave the water.

Bufo americanus and *B. fowleri* are certainly to be looked upon as distinct species rather than as geographical races, yet we have taken a number of toads on the Palisades, and on the northern end of Manhattan Island, which we can not refer satisfactorily to either. Most of them are intermediate in regard to the size of the warts, and a few are as smooth as Fowler's toads but with black spots on the breast. They may represent only the extremes of variation, or they may perhaps be hybrids. This is a question which could be settled only by experimental study, but that there is some possibility of hybridization is shown by the following incident: A male American toad, during the spring of 1909, which was put in a cage with some frogs, was later found clasping a female pickerel frog (*Rana palustris*) to which he clung for several days. Would not such an individual, if unsuccessful in securing a mate of his own species, be quite likely, a little later, to fertilize the eggs of a female Fowler's toad?

W. DEW. MILLER,
JAMES CHAPIN

FURTHER PROOFS OF THE INCREASE IN PERMEABILITY OF THE SEA URCHIN'S EGG TO ELECTROLYTES AT THE BEGINNING OF DEVELOPMENT

USING Kohlrausch's method, I observed an increase in electric conductivity of the sea urchin's egg at the beginning of development, indicating an increase in permeability to ions. Although only one proof is necessary to establish a fact, it is interesting to see other data fall into line.

If an electric current is passed through the egg of *Arbacia punctulata,* the cytoplasm begins first to disintegrate in the region nearest the anode. The red pigment diffuses out of the plastids in this region and turns an orange hue.[1] This is most probably due to the accumulation of anions, which dissociate water, forming acids, and indicates a poor permeability of the plasma membrane to anions. As no corresponding disintegration takes place at the cathode end, the plasma membrane must be more permeable to cations than to anions.

If fertilized and unfertilized eggs in sugar solution be placed on the same slide under the microscope and an electric current of gradually increasing strength passed through, the unfertilized eggs begin to disintegrate sooner than do the fertilized eggs. This difference is also true after the fertilization membrane has been shaken off. Therefore, the unfertilized eggs are less permeable to anions than are the fertilized eggs.[2] A low permeability to anions means a low permeability to electrolytes, since the cations on leaving the egg would be pulled back by the negative field produced by the excess of anions confined, and only the undissociated molecules could diffuse freely.

Since it has been shown that unfertilized eggs are less permeable to anions than are fertilized eggs, we should expect it to be more difficult to plasmolyze unfertilized than fertilized eggs with solutions of non-electrolytes. In solutions of non-electrolytes, the electro-

[1] A solution of the pigment turns pale orange in acid and deep purple and is precipitated in alkali.

[2] Or the electrolytes have diffused out of the fertilized more than from the unfertilized eggs, in either case showing increased permeability.