

consisting of hundreds of small spicules, makes the solution of them possible in a very short time.

The gastroliths have been supposed to possess great medical properties and to perform a variety of functions, the most common and accepted belief being that they play an important part in the provision of lime for the hardening of the new shell. The small quantity of lime which they contain, however, not more than one one hundred and twenty-sixth of that of the entire shell, according to an analysis recently made by Dr. Robt. Irvine, shows that this is relatively unimportant. Fragments of lime furthermore are always at hand, and are frequently eaten by the soft lobster, shortly after ecdysis, in the adolescent stages at least. It is more likely that the gastroliths are the result of excretion of lime which is absorbed from parts of the shell to render molting possible, and that their subsequent absorption in the stomach is a matter of minor importance.

Rate of Growth.—Larvæ increase in length at each molt (stages 2 to 10) from 11 to 15.84%, or on the average about 13.5% (measurements from 66 individuals). The increase in the young at each molt agrees quite closely with that seen in the adult, where the increase per cent. in ten cases was 15.3%. Allowing an increase per cent. at each molt of 15.3—probably not excessive for young reared in the ocean—and assuming the length of the first larvæ to be 7.84 mm. we can compute approximately the length of the individual at each molt.

Length at 10th molt	28.23 mm.	
" " 15th "	57.53 "	
" " 20th "	117.24 "	
" " 25th "	258.90 "	(9.5 inches.)
" " 30th "	486.81 "	(19.1 inches.)

According to this estimate a lobster two inches long has molted 14 times; a lobster 5 inches in length, from 20 to 21 times; an adult from 10 to 11 inches long, 25 to 26

times; and a 19-inch lobster, 30 times. These estimates do not, I believe, go very far astray. We see them practically verified up to the tenth molt.

The time interval between successive molts is the next point to consider. Here the data are very imperfect. How long is the three-inch lobster in growing to be six inches long? Probably not more than two years and possibly less. This is supported by the observations of G. Brook. We therefore conclude that a ten-inch lobster is between four and five years old, with the highest degree of probability in favor of the smaller number.

FRANCIS H. HERRICK.

ADELBERT COLLEGE.

THE NEWARK SYSTEM.

IN an article in a recent number of SCIENCE* Professor C. H. Hitchcock again objects to the use of 'Newark' as a group name in geology. This article is essentially a republication of a portion of a paper by the same author, which appeared in the American Geologist in 1890† in criticism of an article of mine in the same journal,‡ in which reasons were presented for reviving the use of Newark as a name for a certain system of rocks.

I replied§ to Professor Hitchcock's objections and criticisms, and showed conclusively, as I believe, that the term referred to has precedence over all other names applied to the system in question, which do not imply correlation. In his recent article Professor Hitchcock does not so much as mention my rejoinder; but is of the opinion that the considerations presented in his earlier paper 'would have been sufficient to convince any one, looking at the subject judicially and impartially, of the inadequacy

* Vol. 1, New Series, Jan. 18, 1895, pp. 74-77.

† Vol. 5, 1890, pp. 197-202.

‡ Vol. 3, 1889, pp. 178-182.

§ Am. Geol., Vol. 7, 1891, pp. 238-241.

of the name Newark to special recognition.' On the other hand, I am of the opinion that my reply should have silenced opposition. There is, thus, a radical difference of opinion between us. There is also a question of fact involved. Has Newark priority as a group name? This is a simple historical question that almost any one can decide from the documentary evidence. In the papers described in the following foot-note* I have presented or referred to all of the evidence known to me bearing on the question.

In Professor Hitchcock's recent article there are many statements that have no relation to the matter under discussion, since they refer to usages of later date than the introduction of the term Newark. No legitimate arguments are advanced that are not in the former paper, and as these have all been answered, there is nothing left for me to do but to follow my opponent's example and republish my reply to his five-year-old criticism.

My paper in the *American Geologist* for April, 1891, reads as follows:

"IN a brief paper on the Newark system published in this journal [*Am. Geol.*] about two years since,† I proposed a revival of 'Newark' as a group name for the reddish-brown sandstones and shales and associated trap rocks of the Atlantic coast region, which had previously been quite generally referred to the Triassic and Jurassic. A long list of names was presented that had been used to designate the rocks in question; nearly all of which implied correlation with European terranes, ranging from the Silurian to the Jurassic. The advisability of adopting a name that did not indicate re-

lationship with distant formations was also pointed out. The first name on the list referred to which met this requirement was 'Newark group,' proposed by W. C. Redfield, in 1856. That this was a group name, intended to indicate the entire formation, is shown by the language used. Redfield's words are:

"I propose the latter designation [Newark group] as a convenient name for these rocks (the red sandstone extending from New Jersey to Virginia) and to those of the Connecticut valley, with which they are thoroughly identified by foot-prints and other fossils, and I would include also the contemporaneous sandstones of Virginia and North Carolina."*

As stated in my previous paper, the term 'group' has been adopted by the International Congress of Geologists in a wider sense than was implied by Redfield. I therefore suggested that 'system' should be substituted instead. Before offering the suggestion I made what I believe to have been an exhaustive examination of the literature relating to the terrane in question, and concluded that Redfield's name had precedence over all other names that had been used which did not imply correlation.

The term Newark system has recently been adopted by several geologists, in accordance with my suggestion, and up to the present time but one voice has been raised against it. In an article on 'The use of the terms Laurentian and Newark in geological treatises,' published in this journal, † Prof. C. H. Hitchcock has formulated five objections to its acceptance. These will be considered in the order in which they were presented.

First. It is claimed that 'An essential feature of a name derived from a geograph-

* The Newark System, *Am. Geol.*, Vol. 3, 1889, pp. 178-182.

Has 'Newark' priority as a group name, *Am. Geol.*, Vol. 7, 1891, pp. 238-241.

The Newark System, *U. S. Geol. Surv.*, Bull. No. 85 (Correlation Papers) 1892.

† Vol. 3, 1889, pp. 178-182.

† *Am. Geol.* 5, April, 1889, p. 251.

* *Am. Jour. Sci.*, 2d ser. 1856, Vol. 22, p. 357; also in *Am. Assoc. Adv. Sci.*, Proc., Vol. 10, Albany meeting, 1856, p. 181.

† Vol. 5, 1890, pp. 197-202.

ical locality is that the terrane should be exhibited there in its entirety or maximum development; and that the territory about Newark, N. J., does not meet these requirements for the Newark system.

Without dissenting from the wisdom of the rule proposed, although a large number of exceptions could be found to it in the best geological memoirs, I wish to state from my own knowledge that the region about Newark may be taken as typical of the terrane named after that city. The characteristic reddish-brown sandstones and shales are there well exposed, and in the neighboring Newark mountains the associated trap rock occurs in sheets of great thickness. This statement is sustained by Prof. Hitchcock's own words, a little farther on in the paper cited, where he says, "the New Jersey terrane possesses the distinguishing features of the Trias quite as well as the one in New England."

That *Passaic* would have been a better name, as Prof. Hitchcock suggests, is perhaps true, but the one before us was definitely selected and has priority.

Second. It is stated by Prof. Hitchcock that the name 'Connecticut or Connecticut River sandstone has priority over Newark,' and was used by several geologists before Redfield's proposal in 1856, 'though none of them had proposed it as a geological term.' The admitted fact that no one had used the name referred to as a geological term, relieves me of the necessity of showing that Redfield's name has priority.

In the writings of the older geologists among whom Prof. Edward Hitchcock will always take the first rank as an investigator of the sandstones of the Connecticut valley, the terms 'Connecticut sandstone,' or 'Connecticut River sandstone,' were used in the same sense as the coördinate term I have just employed, *i. e.*, as a geographical designation; just as they might have referred to the granite of Massachusetts without any

intention of proposing a group name. The fact that the older geologists, and among them Prof. Edward Hitchcock, spoke of the Newark rocks of New England under definite group names, implying correlation, is sufficient evidence that they did not recognize the value of an independent name.

Third. It is stated that Prof. J. D. Dana adopted the name proposed by Redfield, in his lectures, but did not use it in his subsequent writings. Prof. Dana's reasons for this course have never been published, and so far as it is a precedent—happily precedents have less weight in geology than in some other professions—it indicates that we should first use the name Newark and then abandon it for other names implying indefinite correlation with distant terranes.

Fourth and Fifth. While it is admitted that the terrane under discussion is quite as well represented in New Jersey as in the Connecticut valley, it is claimed that the latter having been studied first, should have furnished the group name. I fully agree with Prof. Hitchcock in this, and could add several other group names which to my taste might be improved, but the author of a geological name, like the palæontologist who describes a new fossil, is entitled to priority. To attempt to introduce a new name for a group of rocks already sufficiently well designated, would only bring confusion, similar to that produced by the great variety of names implying correlation that have already been used for the Newark system." ISRAEL C. RUSSELL.

UNIVERSITY OF MICHIGAN.

DEATH OF GEORGE N. LAWRENCE.

THE veteran ornithologist, George N. Lawrence, died at his home in New York City, Jan. 17, 1895, at the age of 89 years. He was born in New York, Oct. 20, 1806. His wife, to whom he had been married more than sixty years, died only five days earlier.