plants, which cannot be grown under similar conditions. The fact that they will grow freely in soil containing ammonia, or decomposing animal matter convertible into ammonia, led to the conclusion that they wanted nitrogenous food. The fact that the nitrogen is not an important element of their substance at any period leads me to infer that these plants are incapable of decomposing water, and consequently dependent for their necessary supply of hydrogen upon ammonia or some other compound of hydrogen more readily decomposed than water. It is well known that while the nitrates of potash, soda, lime, etc., are all valuable auxiliaries to farmyard manures, they are of no value as a substitute for it. Very eminent chemists have been somewhat staggered at the results of their experiments in this direction; but precisely as the function of nitrogen in ammonia is to carry hydrogen, so the function of the nitrogen in the nitrates is to carry potash. Whether we dress the soil with nitrate of soda, lime, or potash, the result is the same. With potash salts in the soil, the addition of the nitrates of soda or lime leads to a double decomposition, and the conversion of the potash into nitrate. Sulphates and chlorides of these bases appear to have some small value as manure, although their composition remains unchanged; but in the mysterious laboratory of the growing plant the nitrate of potash is resolved into its elements. The potash allies itself with carbonic acid to form carbonate, or with carbon, oxygen, and hydrogen in various proportions to form the organates of potash (the citrates, tartrates, oxalates, etc.), so important to the development of fruits.

Whether we employ ammonia or the nitrates as manure, the nitrogen is liberated in the plant to unite with oxygen, and be radiated as common air. In the one case, hydrogen remains; in the other, potash.

The current theory of nitrogenous manure appears to be based on a complete misconception as to the function of the nitrogen in its various compounds; and when it is once clearly realized that hydrogen is the important food-substance yielded by ammonia, it will be of practical interest to determine whether this substance cannot be supplied more economically by the decomposition of water *secundem artem*.

C. F. AMERY.

Geological Questions.

THE replies to the following questions by some of the most eminent American geologists have induced me to ask your assistance in getting a wider circle to consider them. They were framed for the purpose of enabling the writer to properly represent American thought on the subjects mentioned, in his report on the Archaean to the American Committee in August next. Those geologists who are willing to render the undersigned the valuable assistance of expressing their opinions on the matters involved, are requested to write the letter of the question, and give the answer as laconically as is consistent with a clear statement of their views. In alternative questions, like J or N, it will suffice to append the numbers of the clauses representing their opinions.

A. Do you agree to the suggestions contained in the report of the International Committee on Nomenclature ('Report of the American Committee on the Work of the Geological Congress,' pp. 49 to B, p. 57)? Please state explicitly if you are willing to accept the recommendations of the congress.

B. Do you favor the division of the Archaean Group into a definite number of systems? If so, give their names and the order of their succession.

C. Give the horizons of non-conformability in the Archaean.

D. Do you approve of the plan of subdividing the Archaean petrographically and of omitting corresponding chronological divisions and names?

E. Should the eruptives occurring in the Archaean rocks be classified with the latter, or separately?

F. Which, if any, of the following terms is applicable in American geology, and how applied? 'Hebridean,' 'Dimetian,' 'Arvonian,' 'Pebidian.'

G. Are there crystalline rocks in, and after, the Paleozoic lithologically indistinguishable from those of the Archaean?

H. Are there any crystalline rocks in the Archaean which do not occur later?

I. Is mineral constitution indicative of geological age?

J. Are the lower stratified crystallines: (1) of aqueous origin metamorphosed partly, or wholly, by igneous action; (2) of igneous origin metamorphosed in part, or in whole, by subsequent agencies; or (3) partly one and partly the other?

K. Are there evidences of organic life in the Archaean; if so, where, and what?

L. In your opinion, is Eozoon Canadense of organic origin?

LL. Do you approve the European map committee's (Professor Lossen's) system of coloring and classifying the eruptives?

M. Should Serpentine constitute one class of eruptives?

N. Is Serpentine, (1) sometimes, or (2) always an alteration product: (3) of eruptives, (4) of sedimentary rocks, or (5) of either?

O. What, in your judgment, is the proper disposition of the term 'Taconic?' If employed, what are its limits, and what terms should it replace?

P. How should the Cambrian be divided?

Q. Are 'Menevian,' 'Ordivician,' or any other more or less comprehensive foreign names, applicable in American geology? if so, how?

PERSIFOR FRAZER,
Reporter for Archaean.

Philadelphia, 201 South Fifth St., July 9.

The Charleston Earthquake.

IN reply to Prof. Joseph Le Conte's valued criticism (*Science*, x. p. 22), I would say that it seems to me that the method for estimating the depth of an earthquake-focus proposed by Mr. Hayden and myself differs radically from that proposed by Mallet in the 'British Association Report' of 1858. His inference that the horizontal motion has a maximum value where the 'angle of emergence' is 54° 44′ could be true only of normal waves. It cannot be true of the transverse waves. He ignores the transverse waves entirely in his formula; and the omission, I maintain, is fatal to its applicability. He also ignores the vertical component of the normal wave, which at such an angle is much more energetic than the horizontal component. What proportion of the horizontal motion is due to the normal waves can generally be determined at considerable distances from the origin when the facts upon the ground are clearly manifested. But at the very localities where such a determination is necessary for the application of Mallet's method the difficulty is greatest. It is just here, too, that all the components, vertical and horizontal, normal and transverse, blend together with such effect that not one of them can be ignored without fatal error. We must consider their total effect. But these motions compounded represent the intensity, i.e., the amount of energy per unit-area of wave-front. Mallet's 'circle of greatest destructiveness' has no real existence. It is a purely mathematical abstraction obtained by postulating conditions which do not have any separate existence.

Since writing the above, I have recurred to Mallet's paper, and find the following: "It is certain that in all great earthquakes the real mischief and overthrow at places pretty far removed from above the centre of impulse are done by the blow from the normal wave, which appears to come first; hence, the main observable effects are those of the normal, and we are justified and enabled, *in such localities*, to neglect the transversal. But within a considerable circle of area, whose boundary is evanescent, and whose centre lies at the point right above the origin, the actual effects of the transversal wave are very formidable, and can never be neglected." [Then why should he have suggested doing so?] "The ground beneath an object so situated, such as a house or pillar (as the distance from the origin to the surface is the minimum range of emergence, or shortest possible, and its energy therefore the greatest), is almost at the same instant thrown nearly vertically upwards by the normal wave, and at the same moment rapidly forced forwards and backwards in two directions orthogonal to each other; and this combined movement, which is that called 'vorticoso' by the Italians and Spanish Mexicans, is one that nothing, however solid and substantial in masonry, etc., can long withstand."

It is certainly a pleasure to find Mr. Mallet reasoning so justly; but in the remarks quoted it is apparent that he is taking account of