sixth lectures. The other lectures, already noted as of importance to scientific readers, really deal with the metaphysical conclusions which modern inquiry, broadly viewed as a whole, most fully warrants. They constitute the first attempt in the United States, so far as I know, to supply a reasoned account of first principles from the standpoint—the only reasonable, and therefore the only defensible one as I think—that human experience is a closed circle, and that if it is to be justified at all, justification must proceed from within this circle.

This is not the place to attempt an estimate of Mr. Royce's contribution to 'natural theology' (*i. e.*, philosophy of religion); moreover, it were more just not to anticipate his second series of lectures, in which he promises to apply his principles. I wish, in conclusion, to draw the attention of mathematicians to the importance of the Supplementary Essay. Written in reply to Mr. F. H. Bradley's conclusions, in 'Appearance and Reality,' it is necessarily of a most technical character. But its suggestiveness will repay some effort. It will serve, also, as I believe, to render many more completely conscious of the change that the last fifty years have wrought upon the old ideals of definiteness and accuracy. These, indispensable desiderata as they are, possess certain limitations. Perception of these limitations has led some to reconsider conceptions once deemed fundamental without question. No doubt, as Mr. C. S. Peirce seems to indicate (SCIENCE, No. 272, pp. 430 ff.), Mr. Royce may be mistaken regarding some matters that lie specially within the purview of the mathematical expert. But, all the same, so far as I am capable of judging, no one can fail to be stimulated by his discussion, not merely of Bradley, but also of Cantor and Dedekind. If he were to have formulated no more than a forcible illustration of the intimate connection between mathematical and metaphysical problems, he would have earned our warm congratulations.

It need hardly be added that the book is one with which all workers in Professor Royce's own field will have to reckon.

R. M. WENLEY.

UNIVERSITY OF MICHIGAN.

A Preliminary Report on the Geology of Louisiana. By GILBERT D. HARRIS and A. C. VEATCH. Baton Rouge. 1900. 8vo. Pp. 354. Pl. 62.

This report on the geology of Louisiana is the first annual report of Professor Harris and one of a series of annual State reports bearing on agriculture, geology, and the development of the State, which are issued under the auspices of the State Board of Agriculture, and distributed free on application. It covers the operations for the season of 1899, and in printing, illustration, etc., is very well gotten up, though, as in many State reports, there are rather more than a fair share of typographical errors. There is an excellent index which is a boon to be thankful for, though, curiously enough, there is nowhere any date of publication.

The contents are divided into three sections (I) an historical synopsis of previous geological work done in the State; (II) general geology; and (III) special reports by various authors, in this case including the geology of the salt mines of the Five Islands, reports on clays, on fossil plants and invertebrates and a popular article on fungi injurious to standing timber.

From the well-known energy and acquirements of the geologist in charge, ably assisted by Mr. Veatch, one naturally expects the clearing up of problems which have long puzzled geologists, with other positive additions to geological knowledge. And, since Professor Harris is a paleontologist and stratigrapher, we do not expect to see complicated questions settled off-hand on the physiographic aspect of a few gravel banks. Nor are these anticipations disappointed.

Earlier workers, especially Hilgard, have insisted on the presence of cretaceous rocks in Louisiana, but their distribution has been more or less uncertain and in the absence of skilled paleontological assistance Lower Eocene fossils have been sometimes taken for Cretaceous remains, etc. One important result of the current work has been the establishment of the fact that the upper Cretaceous (Ripley) under its blanket of Tertiary strata, extends, with a general parallelism to the old Eocene shore line, in many folds in a NE–SW direction. A fairly good list of Cretaceous fossils has been secured,

though, as in the other strata of the State, the preservation of the fossils leaves much to be desired. It is to be regretted that the absurd pale yellows allotted by international agreement to the Tertiary, make it almost impossible to prepare an intelligible map of a Tertiary region in color. We should advise Professor Harris in future to use plain black and white symbols for this purpose.

The work on the Tertiary accomplished by this survey is most important, and would have been impossible for any one less versed in the lower Eocene paleontology than Professor Harris. He demonstrates the presence of the Midway horizon in Louisiana, for the first time, in two localities and further search will doubtless reveal others.

The Chickasawan (Mansfield of Hilgard's earlier work and one of the multitudinous 'Lignitics' of authors) is now found to cover a large area in Louisiana. Parts of it, through absence of expert paleontological knowledge, have been referred to the Vicksburg, Jackson, Claiborne and other subdivisions of the Eocene, in earlier work. Now we have its boundaries approximately defined and a well illustrated faunal list of species provided. In future work we trust Professor Harris will discard entirely the obsolete and misleading name of Lignitic and adopt the geographical term for this stage which is accepted by the majority of geologists interested in this horizon.

Jacksonian strata extend, as the author shows, from the Oachita river to the Texas boundary, while the Oligocene beds of the Vicksburg horizon are confined to the region between the Oachita and Red rivers.

Considering the small appropriation available for the work, the State of Louisiana is to be congratulated on the amount and quality of that which has been accomplished. It is to be hoped that Professor Harris may be able to continue his labors, and that the perplexities presented by the Pleistocene deposits of the State may yield to persistent study in the future.

W. H. Dall.

The Physiological Rôle of Mineral Nutrients. By Dr. Oscar Loew. Bull. 18, U. S. Dept. of Agriculture. 1899.

Dr. Loew discusses the actual part of the various mineral substances in the physiology of the vegetable organism, a matter of prime importance to the agricultural experimenter, as well as the botanist. Every advance in this subject has been won by the most arduous labor, and only in a few instances may the conclusions reached be considered as final.

The treatment of such an unsettled subject within the limits of a bulletin must result in many omissions in order to bring points of the greatest interest prominently to the attention. By reason of such necessity one does not find the names of Wieglieb, Marcgraf, Senebier, or Boussingault in the historical resumé of the subject, which otherwise traces the course of investigation on the subject somewhat clearly.

Phosphoric acid is necessary for the formation of the essential constituents of the nucleus and plastids, inclusive of the chloroplasts and chlorophyll; secondary potassium phosphates are found in combination with certain proteins; iron takes part in the formation of chlorophyll although it does not enter into the composition of the molecule of this substance, and is not to be considered of more importance in this connection than many other substances. Attempts to replace iron with manganese have met failure so far. Chorides are necessary for but few species; they are taken up in quantity by aquatics and other plants however.

The presence of potassium salts seems necessary for the synthesis and translocation of carbohydrates and proteins. This element may be replaced by rubidium or caesium in certain fungi.

The relation of calcium salts to the translocation of carbohydrates is not clearly defined, but this substance is abundant in all parts of the bodies of the higher forms of plants. It is notable that many of the simpler organisms may exist and attain full development without this element, and Dr. Loew advances the theory that the development of the higher plants both in form and differentiation of function becomes possible only when the capacity to assimilate calcium and use the resulting calcium proteid compounds is acquired; a theory which is based chiefly on coincidence.

Magnesium is found in nuclear substances