hundred and twenty hours or thereabouts that form the available allowance in a single term, even after the attainment of a fair knowledge of phænogamic botany. To acquire the necessary skill in the use of the compound microscope will alone consume no small part of the time, and without this nothing of value can be done among the cryptogams.

Again, to tell a class the name of a plant instead of teaching them how to discover it for themselves is to rob the study of much of its special value in training the faculties of observation. This part of the work compels a close and repeated examination of the plant and renders the parts and their names thoroughly familiar as no other method can do it. And speaking from a long experience, I cannot believe that the art can be acquired by less practice than that afforded by the analysis of the fifty or more specimens usually required, unless, as is sometimes, and as should be always done, the description of the plants is made a part of the work. And this description should consist not merely of the filling up of the forms usually supplied, whereby the exercise is robbed of much of its value, but by requiring the whole from the scholar, thereby training him in recollecting what to look for without suggestions or leading questions. No practice in elementary botany is so useful as this.

Of course a part of every class, especially if it is large, will shirk the labor when they are out of the class-room. But shirking in the way suggested can easily be prevented by giving a plant which has no English name and in general by testing a scholar's progress by the work done in the class-room from day to day.

I need not do more than allude to the difficulty, I may say the impossibility, of supplying elementary classes with microscopes of sufficient power for the purpose advocated in the paper here referred to, without which the study must degenerate into a mere absorption of what the teacher tells. This would be little more than a waste of time and a degradation of science to the level of a mere memory study.

On yet one other point I must disagree with this author. There was, some years ago, a disposition to begin the study of a science at the bottom and work upward, and this in spite of strong remonstrances from many teachers of great ability and experience. Even a man like Huxley fell into this error, as may be seen in the early editions of his "Biology." But a few years' test showed the many disadvantages of this method, and the opposite, or older plan has been readopted. Whatever may be urged from the standpoint of theory, practice is unanimous on the other side. Steady advance from the known to the unknown is easier than a plunge into the mysteries of cryptogamic botany with its abstruse terminology and its minute, often almost invisible structure. For every one who might be attracted by the delicacy and difficulty of the subject a thousand would be disgusted and disheartened and would forsake the study forever.

The author's illustration from geology is unfortunate because in teaching this subject the best plan is to begin neither with the superficial nor the deep rocks. This savors of book geology. The proper plan is to begin with whatever rocks happen to lie within the range of the student's investigation. Here again we work from the known to the unknown.

The object of the teacher in every study should be to stimulate to farther advance, and this cannot, I think, be accomplished except by beginning with the easy and the obvious, and by assigning tasks well within the strength of the student. If a fair acquaintance with the structure of the phænogams and the methods of phænogamic botany can be attained in the first term devoted to the study, the time will have been well spent, and neither the teacher nor the average scholar can reasonably expect much more.

E. W. CLAYPOLE.

Akron, Ohio.

CORAL REEF FORMATION.

IN *Science* for Oct. 20, p. 214, I observe that Professor Perkins gives a succinct account of the history of the theories of coral reef formation. Darwin and Dana have, of course, their proper place in connection with the *"subsidence theory."* Agassiz is justly mentioned as declaring that there was no subsidence in the case of the Florida reefs. Guppy and Semper are very properly mentioned along with Murray in connection with the new views; but my name is not mentioned in that connection. Let me, then, quote from a paper of mine read before the A. A. A. S., Aug., 1856, and published in the Proceedings and also in the *Am Jour.*, Jan., 1857: "On sloping shores with mud bottom, such as we have supposed always existed at the point of Florida, a fringing reef cannot possibly be formed, for the water is rendered turbid by the chafing of waves on the mud bottom; but at some distance (in this case ten to twenty miles), where the depth of sixty to seventy feet is attained, and where the bottom is unaffected by waves, the conditions favorable for coral growth would be found. Here, therefore, would be formed a *barrier reef*, limited on one side by the muddiness and on the other by the depth of the water."

This is positively the first attempt to explain barrier reefs without resorting to subsidence. Captain Guppy worked out the same explanation independently long afterward, but on becoming acquainted with my paper promptly acknowledged the anticipation of his views. I quote from a communication by him to *Nature* (Vol. 35, p. 77, 1886): "When I arrived at the above conclusions I was not aware that substantially the same explanation had been advanced thirty years before by Prof. Joseph Le Conte in the instance of the reefs of Florida. * * * * The circumstance that barrier reefs are frequently situated at or near the border of submarine plateaus receives a ready explanation in the view *first advanced* by Professor Le Conte."

When I wrote my paper I did not dream of generalizing my conclusions or of invalidating Darwin's theory except as applied to Florida. The subsidence theory was to me then, as it is now, the most probable general theory for the Pacific reefs. I am little disposed to make reclamations. Except on the score of history, it matters little who first brings forward an idea. My paper is now thirty-seven years old. In the midst of all these discussions of new views I have been silent. My paper, therefore, has almost dropped out of the memory of the younger generation of naturalists. This is my only excuse for bringing it up now.

JOSEPH LE CONTE.

Berkeley, Cal., Nov. 10.

BOOK-REVIEWS.

Tables for the Determination of the Rock-forming Minerals. By F. LOEWINSON-LESSING. Translated by J. W. Gregory. New York and London, Macmillan & Co. 55p., 8vo., $1.25.

THE literature of micropetrology has of late received an interesting addition in the shape of a translation by J. W. Gregory of F. Loewinson-Lessing's tables for the determination of rock-forming minerals. Unlike the *Hülfstabellen zur Mikroskopischen Mineralbestimmung* of Rosenbusch, or the *Tableaux des Mineraux des Roches* of Michel, Levy and Lacroix, the work is something more than a bare list of the rock-forming minerals with their optical properties, but has for its avowed purpose an attempt to apply to micropetrology the system "so long applied in

botany for the rapid determination of plants by using one character after another." In carrying out the scheme six tables are given, of which the first is synoptic, while the second deals with the methods of determination of minerals by the aid of polarized light; in the third the morphological character of the minerals is made the distinguishing characteristic, and in the fourth the determination of the crystalline system. In table five the minerals are classified upon crystallographic grounds, and in table six the positive or negative character furnishes the desired clue to identification. To the original work (published in Russian) the translators have added a brief chapter describing a petrographical microscope and its accessories. The work is not intended to be exhaustive, but rather as introductory to the larger works of Rosenbusch and others. To students beginning the study, and particularly to those working without instruction, the book cannot fail to be of great service.

The Mummy; Chapters on Egyptian Funereal Archæology. By E. A. WALLIS BUDGE, L.D., F. S. A. Cambridge, University Press. 404p., with 88 illustrations, 1893, $3.25.

IN his preface the author justly observes: "The preservation of the embalmed body or mummy was the chief end and aim of every Egyptian who wished for everlasting life." Hence, a large proportion of the monuments and remains of ancient Egypt are of a sepulchral character, and an intimate acquaintance with what relates to their mortuary beliefs and ceremonies well nigh exhausts Egyptian archæology.

Impressed with this fact. Dr. Budge has chosen "the mummy" as the one object of study, but this in the widest relations. He begins his volume with a brief sketch of the history of the lower Nile valley, furnishes a list of the dynasties, the cartouches of the principal kings, and a list of the nomes or provinces. Next, beginning with the Rosetta stone as a text, he describes succinctly the discovery of the methods of reading the hieroglyphic writing. This brings him to his immediate subject, the mummy, its preparation and surroundings. Short but satisfactory descriptions are given of such appurtenances as mummy cloth, Canopic jars, the Book of the Dead, *ushabti* figures, sepulchral boxes, vases, toilet articles, scarabs, amulets, figures of the gods and sacred animals, sarcophagi and tombs. Mummies of animals, reptiles, birds and fishes receive some attention, and there are instructive paragraphs on Egyptian writing and writing materials, and the Egyptian numbers and months. The book closes with lists of the more common hieroglyphic characters and determinatives. The whole is presented with great clearness, and with a full, accurate and scientific knowledge of the subject. As a practical handbook to Egyptian archæology, it has no superior, within the lines the author has laid down for himself.

The Outdoor World. By W. FURNEAUX, F. R. G. S. New York, Longmans, Green & Co. 411 p.

Our Household Insects. By EDWARD A. BUTLER, B. A., B.Sc. New York, Longmans, Green & Co. 342 p.

The Industries of Animals. By FREDERIC HOUSSAY. Imported by Charles Scribner's Sons. 258 p., $1.25.

A History of Crustacea. By REV. THOMAS R. R. STEBBING, M. A. New York, D. Appleton & Co. (International Scientific Series, Volume 71). 466 p., $2.00.

DURING the last few years the laboratory naturalist has very largely taken the place of the old student in natural history, and work on biological subjects in general is to-day quite largely carried on in the laboratory by means of the microscope and the dissecting knife. The reason for this can be largely traced to our modern education, which, in trying to introduce biological subjects into educational curricula, must do it in such a way that the student can carry on his work in different branches at the same time. This is hardly compatible with a very widely extended field work. As the result of this laboratory method, laboratory text books and laboratory technic have become well developed and well known, and readily meet the student's requirements. The general public, however, will always be more interested in the side of natural history that treats with animals and plants in a general way, and books to be widely instructive must contain facts never to be learned in the laboratory. Even the laboratory naturalist himself finds relief and pleasure in leaving his scalpel and microscope and turning through the pages of some well written book upon the study of nature on a broader scale. The four zoölogical books above listed represent a better class of the popular scientific books which attempt to deal with phases of nature in a wider way and in a more popular style.

The first of the four is a book designed for boys and young people in general, and has for its purpose the attracting young students to the study of nature. This book attempts to give descriptions and figures of such common animals and plants as a wide awake boy might be able to obtain by ordinary collecting methods. Methods of collection are given, simple and readily obtained forms of apparatus for collection are described, and directions are given the reader as to where and how he may most likely find certain animals and plants. In the different chapters of the book different groups of animals and plants are taken up for discussion and description. The book abounds in figures describing the organisms mentioned, as well as the apparatus used and methods of preservation. The scope of the book covers all types of animals which the boy may be supposed to find, from the smallest (not including microscopic animals) to the largest, and from coelenterates to man. It comprises the study of fresh water, land and marine animals, and is arranged in such a way as to give the boy an interest and a zest in his study of nature in whatsoever line he chooses, and withal a deal of scientific information is given. The book is, in short, just the sort of text book that a boy wants to interest him in natural history, and the figures, many of which are colored, are such as both to attract and instruct.

The second of the four is of quite a different character and is designed as an introduction to entomology. It gives an anatomical and a general account of such common insects as one may find in and around his home. The anatomical description is illustrated by figures and is more or less detailed. Bits of history of different species of insects are introduced, many accounts of interesting habits are described. As the insects are taken up one after another, the author brings up for discussion just the sort of questions which the semi-scientific reader will desire to ask and have answered. He discusses such matters as the poison of mosquitoes; the origin and habits of flies; the distribution and origin of cockroaches; methods of getting rid of many of the insect pests, etc. Quite a number of excellent figures are given illustrating the anatomy, and a few excellent photographic plates of some of the smaller insects are introduced. This book, in short, gives the sort of an account of common insects as the elementary student in entomology may desire to have.

Both of these books being English books, the species described and figured are English species. They are for this reason less valuable to an American student, but at the same time the difference in species between English and American is not so great that the books are not usable here.

The third book is even more entertaining to the gen-