the chief phenomena revealed, when either plane or convergent polarized light are employed, are absolutely indispensable. But in addition to these there is a vast mass of knowledge, which has been gradually acquired and is ever increasing, concerning the internal peculiarities of minerals, especially such as appear in the varieties that constitute rocks, and with respect to the wonderful series of changes which they undergo when exposed to different conditions; and the more of this kind of knowledge the student can bring to the investigation of a rock the less liable will he be to fall into error. In this branch of science, as in every other, the experience which can only be obtained by long-continued study of the subject must always supplement, and may sometimes even supersede, the results obtained by the application of rigid rules of procedure.

As a suggestion has recently been made in the pages of NATURE that all which is required to secure a uniform and uniformly-acceptable classification and nomenclature of rocks is that some master of the modern methods of research should bring in a sweeping "reform bill" on the subject, it may be well to quote the author's views upon petrographic notation and classification. Writing after the two years of careful labour devoted to the preparation of this work, he remarks:—

"As regards the classification of rocks, I am sorry to say that increasing knowledge has not tended to bring about any clearness of view. The more rocks are studied the less they seem to me to adapt themselves to any classification at all comparable in definiteness with the classifications of organic bodies and mineral substances. Rock-masses often vary so much in composition and structure that any scheme of classification based on work done in the laboratory is unsuitable for the expression of broad geological facts. It is absolutely impossible to map the different varieties recognized by modern petrographers. The conclusion at which I have arrived is that the necessity for giving names to rocks arises rather from work done in the field than from work done in the laboratory. Rock specimens are mineral-aggregates, and may be described as such. Rock-masses are integral portions of the earth's crust, and possess a certain amount of individuality in virtue of their mode of occurrence."

With these remarks we very cordially agree. Systematic mineralogy is a branch of natural-history science; for, in their crystalline forms and chemical constitution, minerals supply safe criteria which enable us to define species and varieties, and also permit us to group these into larger divisions. But most petrographical classifications seem to be of value only so long as we confine our attention to the selected fragments that fill the cases in a petrographical museum. In the field one type is often found passing into another which the mere petrographer may have placed in a totally different class.

There is perhaps just now a danger of our exaggerating the importance of the microscopic method as applied to the study of rocks. That the method has already done much in enabling us to follow out and trace the effects of the slow processes of change within the earth's crust, and that it will do still more in the future, no one can doubt. But when it is sought to make the microscope a "court of final appeal" in geological questions, and in doing so to disregard the importance of field-observation, we perceive the same source of danger as is now perhaps being

experienced in connection with almost every branch of natural-history research. It must be remembered that, while the microscope enables us to see a little more than the naked eye or the pocket lens, yet nevertheless, between what is actually seen by the very highest powers of our microscopes and the molecular groupings and reactions which give rise to the varied phenomena of the mineral kingdom, there is room for almost infinite possibilities. We accept the teaching of the microscope with all thankfulness, but we recognize the fact at the same time that it has enabled us to get only a very little nearer to the heart of those great physical problems which we aim at solving.

In congratulating the author upon the completion and publication of a book which, as we learn from his preface, has occasioned him no little anxiety as well as so much labour, we may express the hope that his project of treating the aqueous and metamorphic rocks in the same attractive and thorough fashion may be realized. We cannot conclude this notice without a word of commendation for the excellent glossary of terms used in describing rocks, which has been supplied by Dr. F. H. Hatch, and will, we are assured, prove of the greatest service to students.

JOHN W. JUDD.

SILKWORMS.

Silkworms. ("Young Collector Series.") By E. A. Butler, B.A., B.Sc., Author of "Pond Life: Insects," &c. (London: Swan Sonnenschein, Lowrey, and Co., 1888.)

THE silkworm is so familiar an insect to everyone, and is interesting from so many points of view, that we gladly welcome this small volume from the pen of a well-known writer on popular natural history. The space which can be allotted to this subject in works on general zoology, or even on general entomology, is necessarily small; and when we consider that a whole library could be written on the history and structure of any single insect, a book dealing almost exclusively with *Bombyx mori* should be a useful addition to our entomological literature. The present work is fairly comprehensive in its scope, and is written in such a manner as to be intelligible to everyone, however ignorant of natural history. Numerous woodcuts are added, wherever they seem to be required to elucidate the text.

Mr. Butler appears to be adequately acquainted with his subject, and we have glanced through his book without noticing any very serious errors, or meeting with many statements which we felt disposed to question. But we can hardly accept the inconceivable narrative which Mr. Butler has copied from the *Entomologist* on pp. 78 and 79, about a male and female moth being developed upside down in a single pupa formed by a single larva. Until more instances of a similar nature are recorded, we fancy that most charitably-disposed people will be inclined to imagine that some extraordinary error must have occurred. In this case, and in a few others, Mr. Butler quotes his authorities. Although it would be unfair to expect the author of a work like the present to quote authorities throughout, we think that it would have been more satisfactory to Mr. Butler's readers, especially to those who may wish to go further into the subject, if he had indicated in a brief preface the chief

sources from whence he had derived his information, and how far portions of it were based upon his own observations.

We must take exception to one statement (on p. 79) as rather too sweeping. "Silk-producing *Lepidoptera* belong exclusively to two families, the *Bombyridæ* and the *Saturniidae*." All, or very nearly all, *Lepidoptera* produce more or less silk; but even if we understand Mr. Butler to mean "all *Lepidoptera* which produce silk of economic value," he would still have spoken too positively, for we believe that various species belonging to the *Lasiocampidæ*, and perhaps to other families of Bombyces, have been used as silk-producers in various countries; as, for example, *Libethra cajani* in Madagascar.

Mr. Butler has divided his work into six chapters. The first treats of "The History of Silk Culture," and contains a sketch of the gradual progress of silk-culture and manufacture, and of the introduction of these industries into one country after another, from their commencement in China, according to tradition, about 2600 B.C., to the present time. One point seems to have been overlooked, viz. the modern origin of the name Morea for the Peloponnesus, and its derivation from the mulberry-tree.

The second chapter, "The Silkworm: its Form and Life-History," deals with the metamorphoses, and the external structure and changes of the insect in its various stages. The mode of denuding the wings to examine the neurulation; parthenogenesis, and other incidental matters, are likewise noticed. Mr. Butler objects to the term "nervures" as applied to the branching tubes which traverse the wings of butterflies and moths; but we may be permitted to point out that such terms, when used in a purely technical and conventional manner, though frequently incorrect in themselves, rarely mislead anyone.

Chapter III., "The Silkworm: its Internal Structure," treats, of course, of internal anatomy. Detailed directions are given for dissecting silkworms. The chapter closes with remarks on Lyonnet's great work on the anatomy of the larva of the goat-moth, and with a detailed explanation of the position of *Bombyx mori* in the system of Nature.

Chapter IV., "The Silkworm: its Rearing and Management," notices some of the principal races of silkworms, the manner of rearing them, and the mode of preparing the silk. The last paragraph briefly alludes to some allied species of true *Bombyx*.

Chapter V. deals with "The Silkworm: its Diseases and Imperfections." The three most serious diseases, flaqueur, muscardine and pebrine, are discussed rather fully, as well as M. Pasteur's method of combating pebrine by microscopic examination of brood females.

In the concluding chapter (VI.), the author discusses "Wild Silkworms," many of which he figures. His treatment of this part of the subject is necessarily somewhat brief, but this is the less to be regretted, as those who wish for further information will probably find much of what they require in Mr. Wardle's "Hand-book of the Collection illustrative of the Wild Silks of India, in the Indian Section of the South Kensington Museum." This book was published by the Science and Art Department of the Committee of Council on Education in 1881; and though earlier in date, it will be found a most useful appendix to Mr. Butler's work.

Mr. Butler himself may fairly be congratulated on his success in compressing so large an amount of useful matter as his book contains into the moderate compass of just 100 pages.

W. F. KIRBY.

OUR BOOK SHELF.

Allgemeine Geologie. Von Dr. Karl von Fritsch, Professor an der Universität in Halle. (Stuttgart: J. Engelhorn, 1888.)

THIS is one of a very useful series of volumes which is appearing under the editorship of Dr. Friedrich Ratzel, with the title of "Library of Geographical Handbooks." As the subjects of glaciers and of volcanoes and earthquakes have had special volumes of the series devoted to their discussion, while many other problems of geological interest are treated of in separate monographs, such as those which deal with the geography of the ocean, and the morphology of the earth's surface, Dr. von Fritsch has been able to limit the scope of the work now before us to certain definite lines of inquiry. The first division of the book is devoted to "Geophysiography," or a discussion of the features of the earth as a member of the solar system, and of the relations of the atmosphere and ocean to the lithosphere or solid crust of the globe. The second division, "Geotektonik," deals with the forms and relations of the rock-masses that build up the solid crust, and is treated with considerable fullness, the illustrations being for the most part new, and not of the kind which find a place in the ordinary text-books of geology. In the third part, "Geochemistry," or chemical geology, we have a short sketch of the present state of petrography, or the description of rocks, followed by remarks on petrogeny, or the theory of their origin. It would be unfair to expect, in the 175 pages at the author's disposal, anything like a complete treatment of the numerous and difficult problems presented by petrological science at the present day, but it is certainly possible to conceive of a bolder and more masterly treatment of the whole question than is found in the present work. "Geomechanik," or physical geology, treats of the questions usually grouped by English writers under the head of dynamical geology; and the fifth and concluding portion of the work is devoted to "Geogenie," or a general sketch of historical geology. The work is of interest to English students and teachers of geological science, as illustrating the general methods of treatment of the subject which prevail in Germany. Without aiming at the comprehensive character which belongs to the well-known treatises of Credner and Gümbel, this book forms an admirable sketch of the chief facts, and theories of geological science, which are presented always in an attractive and sometimes in a somewhat novel manner.

LETTERS TO THE EDITOR.

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Functionless Organs.

IN an interesting letter which appeared in NATURE (p. 341), under the above title, the Duke of Argyll brings forward a "doctrine of prophetic germs" as explanatory of certain rudimentary structures. He refers particularly to the electrical organ of the skate, which he regards as an example of such a germ. The doctrine is that these functionless organs are not structures which have been useful, but are endowed with "utilities yet to be."

In the lecture which I gave at the Royal Institution, on "Electrical Fishes," in May 1887, I pointed out, in discussing the particular instance referred to, that the difficulty suggested