

**GEOLOGY,
PP. 7-94**

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Geology, pp. 7-94 by James Geikie

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JAMES GEIKIE

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PREFACE.

THE vital importance of diffusing some knowledge of the leading principles of Science among all classes of society, is becoming daily more widely and deeply felt; and to meet and promote this important movement, W. & R. CHAMBERS have resolved on issuing the present Series of ELEMENTARY SCIENCE MANUALS. The Editors believe that they enjoy special facilities for the successful execution of such an undertaking, owing to their long experience—now extending over a period of forty years—in the work of popular education, as well as to their having the co-operation of writers specially qualified to treat the several subjects. In particular, they are happy in having the editorial assistance of ANDREW FINDLATER, LL.D., to whose labours they were so much indebted in the work of editing and preparing *Chambers's Encyclopædia*.

The Manuals of this series are intended to serve two somewhat different purposes:

1. They are designed, in the first place, for SELF-INSTRUCTION, and will present, in a form suitable for private study, the main subjects entering into an enlightened education; so that young persons in earnest about self-culture may be able to master them for themselves.

2. The other purpose of the Manuals is, to serve as TEXT-BOOKS IN SCHOOLS. The mode of treatment naturally adopted in what is to be studied without a teacher, so far from being a drawback in a school-manual, will, it is believed, be a positive advantage. Instead of a number of abrupt statements being presented, to be taken on

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trust and learned, as has been the usual method in school-teaching ; the subject is made, as far as possible, to unfold itself gradually, as if the pupil were discovering the principles himself, the chief function of the book being, to bring the materials before him, and to guide him by the shortest road to the discovery. This is now acknowledged to be the only profitable method of acquiring knowledge, whether as regards self-instruction or learning at school.

For simplification in teaching, the subject has been divided into sub-sections or articles, which are numbered continuously ; and a series of Questions, in corresponding divisions, has been appended. These Questions, while they will enable the private student to test for himself how far he has mastered the several parts of the subject as he proceeds, will serve the teacher of a class as specimens of the more detailed and varied examination to which he should subject his pupils.

NOTE BY THE AUTHOR.

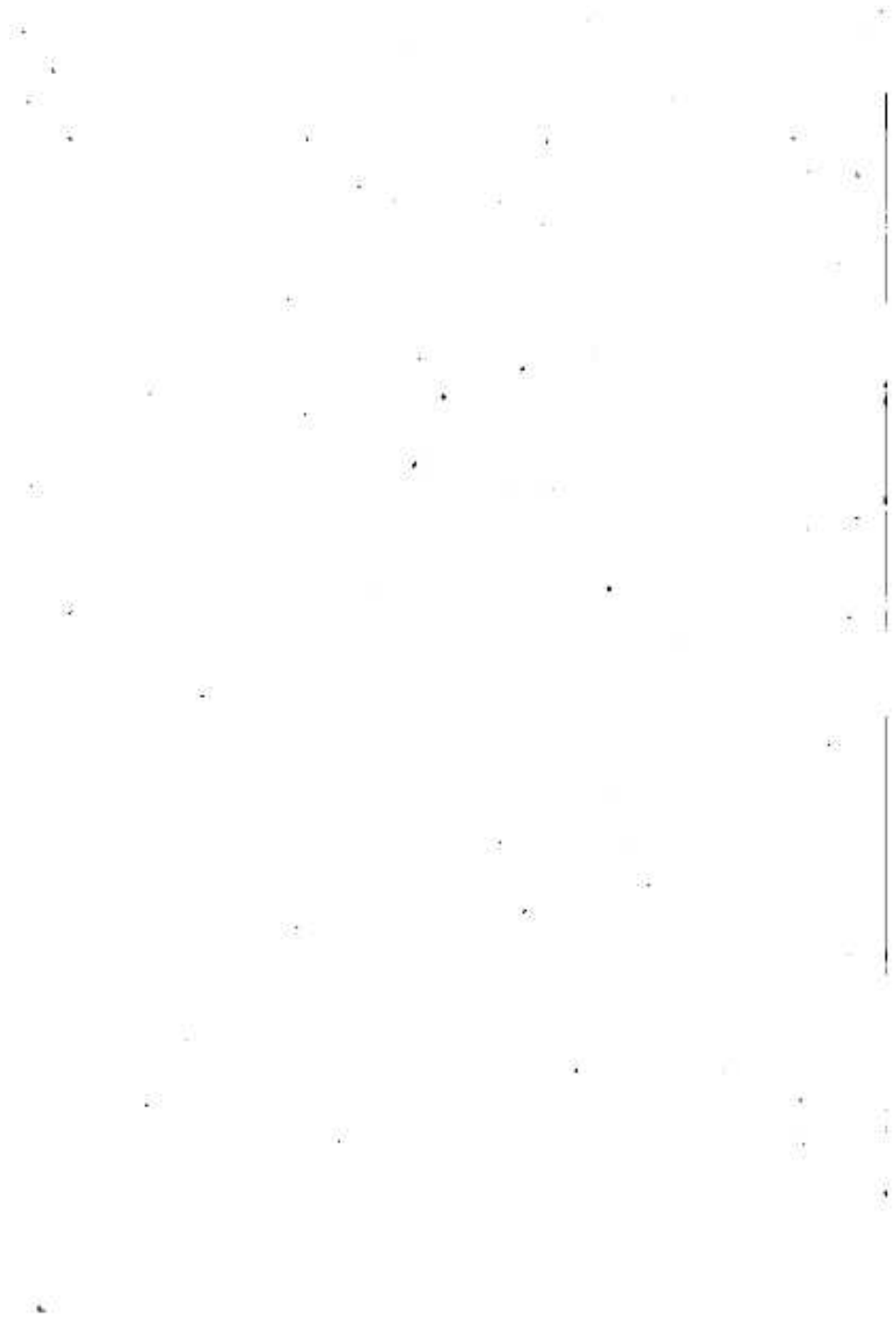
In the present Manual of GEOLOGY it has been the aim of the author rather to indicate the methods of geological inquiry and reasoning, than to present the learner with a tedious summary of results. Attention has therefore been directed chiefly to the physical branches of the science—Paleontology and Historical Geology, which are very large subjects of themselves, having been only lightly touched upon. The student who has attained to a fair knowledge of the scope and bearing of Physical Geology, should have little difficulty in subsequently tackling those manuals in which the results obtained by geological investigation are specially treated of.

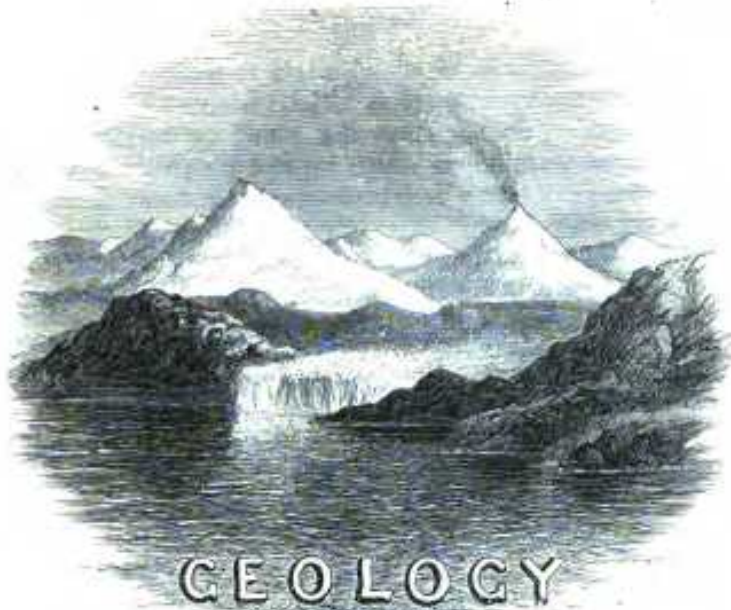
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June 1875.

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INTRODUCTORY.

1. *Definition.*—Geology is the science of the origin and development of the structure of the earth. It treats of the nature and mode of formation of the various materials of which the earth's crust is composed; it seeks to discover what mutations of land and water, and what changes of climate, have supervened during the past; it endeavours to trace the history of the multitudinous tribes of plants and animals which have successively tenanted our globe. In a word, Geology is the Physical Geography of past ages.

2. *Rocks.*—Every one knows that the crust of the earth is composed of very various substances, some of which are hard and crystalline in texture, like granite; others less indurated and non-crystalline, such as sandstone, chalk, shale, &c.; while yet others are more or less soft and incoherent masses, as gravel, sand, clay, peat, &c. Now, all these heterogeneous materials, whether they be hard or soft, compact or loose, granular or crystalline, are termed *rocks*. Blowing sand-dunes, alluvial silt and sand, and even peat,

are, geologically speaking, rocks, just as much as basalt or any indurated building-stone. The variety of rocks is very great, but we do not study these long before we become aware that many kinds which present numerous contrasts in detail, yet possess certain characters in common. And this not only groups these diverse species together, but serves also to distinguish them from other species of rock, which in like manner are characterised by the presence of some prevalent generic feature or features.

Classification of Rocks.—All the rocks that we know of are thus capable of being arranged under *five* classes, as follows:

- I. MECHANICALLY FORMED.
- II. CHEMICALLY FORMED.
- III. ORGANICALLY DERIVED.
- IV. METAMORPHIC.
- V. IGNEOUS.

3. The MECHANICALLY FORMED class comprises a considerable variety of rocks, all of which, however, come under only two subdivisions—namely, *Sedimentary*, and *Eolian* or *Aerial*, the former being by far the more important. Of the *Sedimentary* group, there are three rocks which may be taken as typical and representative—namely, *conglomerate* or *puddingstone*, *sandstone*, and *shale*. A short examination of the nature of these will sufficiently explain why they come to be grouped together under one head. *Conglomerate* consists of a mass of various-sized rounded stones cemented together; each stone has been well rubbed, and rolled, and rounded. It is quite obvious that the now solid rock must at one time have existed in a loose and unconsolidated state, like gravel and shingle. Nor can we resist the conclusion that the stones were at one time rolled about by the action of water—that being the only mode in which gravel-stones are shaped. Again, when we have an opportunity of examining any considerable vertical thickness of conglomerate, we shall frequently observe that the stones are arranged more or less definitely along certain lines. These, there can be no question, are *lines of deposition*—the rounded stones have evidently not