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## **Principles of geology**

**Lyell, Charles**

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Summary of the principles of geology.

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## SUMMARY

OF THE

# PRINCIPLES OF GEOLOGY.

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AFTER some observations on the nature and objects of Geology (Chap. I. Vol. I.), a sketch is given of the progress of opinion in this science, from the times of the earliest known writers to our own days (Chaps. II. III. IV.). From this historical sketch it appears that the first cultivators of geology indulged in many visionary theories, the errors of which the author refers chiefly to one common source, — a prevailing persuasion that the ancient causes of change were different, both as regards their nature and energy to those now in action; in other words, they supposed that the causes by which the crust of the earth, and its habitable surface, have been modified at remote periods, were almost entirely distinct from the operations by which the surface and crust of the planet are now undergoing a gradual change. The prejudices which led to this assumed discordance of ancient and modern causes are then considered (Chap. V. to p. 122. Vol. I.), and the author contends, that neither the imagined universality of certain sedimentary formations (Chap. V.), nor the different climates which formerly pervaded

the northern hemisphere (Chaps. VI. VII. VIII.), nor the alleged progressive development of organic life (Chap. IX.), lend any solid support to the assumption.

The numerous topics of general interest brought under review in discussing this fundamental question are freely enlarged upon, in the hope of stimulating the curiosity of the reader. It is presumed that when he has convinced himself, that the forces formerly employed to remodel the crust of the earth were the same in kind and energy as those now acting, or even if he perceives that the opposite hypothesis is, at least, questionable, he will enter upon the study of the two treatises which follow (on the Changes now in progress in the Organic and Inorganic World, Books II. and III.) with a just sense of the importance of their subject matter, and its direct bearing on Geology.

The first of these treatises, which relates to the changes of the inorganic creation, such as are known to have taken place within the historical era, is divided into two parts. In the first an account is given of the observed effects of aqueous causes, such as rivers, springs, tides, and currents (Book II. Chaps. I. to VIII.) ; in the second the effects and probable causes of the volcano and earthquake, and all subterranean movements, are considered (Book II. Chaps. IX. to XIX.).

The treatise on the changes of the organic world is also divisible into two parts; the first of which comprehends all questions relating to the variability of species, and the limits assigned to their duration (Chaps. I. to XI.). The second explains the processes by which the remains of animals and plants existing at any particular period may be preserved, or become fossil (Chaps. XII. to XVII.).



Under the first of these divisions, the author defines the term *species*, and combats the notion that one species may be gradually converted into another by insensible modifications in the course of ages (Chaps. I. II. III. and IV.). He also enters into a full examination of the evidence regarded by him as conclusive in favour of the limited durability of species. In proof of this, he argues that the geographical distribution of species being partial, the changes constantly going on in the animate and inanimate world must constantly tend to their extinction (Chaps. V. to X.). Whether new species are substituted for those which die out, is a topic on which no decided opinion is offered; but it is contended that if new species had been introduced from time to time as often as others have been lost, we should have no reason to expect to be able to establish the fact during the limited period of our observation (Chap. XI.).

In the second branch of this treatise, the various circumstances under which aquatic and terrestrial plants and animals, as also man and the works of his hands, become fossil, are examined (Chaps. XIII. to XVII.).

The fourth book is occupied with the description of geological monuments strictly so called, the formations termed tertiary being first more fully examined and classified, the secondary and primary rocks being afterwards more briefly alluded to. In the course of this description, it appears that the rocks which compose the crust of the earth have resulted in part from igneous and partly from aqueous causes; others from the combined influence of these agents, the igneous having operated both upon and far beneath the surface. The bearing of the various phenomena

considered in the second book on the interpretation of such monuments cannot fail to be seen.

It is, moreover, shown, that the fossil remains of plants and animals are plentifully included in aqueous rocks of different ages, and that these belong for the most part to species which no longer exist on the earth. It is principally by the aid of such fossils, that the chronological arrangement of rocks is determined; and a careful comparison of the numerous organic remains of the tertiary formations affords some indication of a gradual introduction of the species now living, and a successive extinction of species which previously existed. It is at least clear that during the tertiary epoch entire assemblages of species were not simultaneously swept away from large regions, and others perfectly distinct created in their place. The intimate connection of these phenomena with the subjects investigated in the third book, is sufficiently obvious.