

hypotheses deny the assumption which is the basis of Lord Kelvin's calculations, and thus cast discredit on the resulting age of the earth; but under any hypothesis we are forced to believe that many millions of years have passed since life first appeared on the earth. We get still further conception of the vast lapses of time which these early rocks imply, when we discover that, even after the waters had become suited for living beings, a greater part of the development and differentiation of organic life went on in forms which have left no trace of their existence. Hardly a more remarkable fact confronts us in geology than the variety and the complexity of types in the earliest rocks which contain any trace of life at all. The fact which is all the more remarkable for being attested by the best evidence from all parts of the earth's surface, compels us to assign to the history of life before its first permanent record was made, a longer period perhaps than all the time that has since elapsed, unless the view more recently advanced, that acceleration of development took place in the case of the earliest sea-floor dwellers, is shown to be true. The earlier forms were either unsuited for preservation or else they have been obliterated in the subsequent alteration of the rocks containing them.

All of the oldest rocks which are to-day entirely without, or with only slight traces of former life, are referred to the first great division of geological history called *Archean Time*. These oldest rocks are largely crystalline in character, so that there can be but little chance of encountering organic forms, even had they earlier existed in the strata. Even the least altered deposits, although they have afforded a few scattered remains of archaic forms at certain points, contain nothing more than the merest traces of the organisms of this early time.

When, however, life does once appear in all its variety, it is well-nigh the same in all the older rocks. In the most widely separated localities the same types occur in rocks of the same age, and this furnishes us with the key to the succession of deposits. From the time when the oldest fossil-bearing stratum was deposited until now, the story of life-progress and development is told by the rocks with sufficient clearness to be unmistakable. Local differences of conditions have probably always prevailed, as they do now, but the same types of organisms have always lived at the same time over the entire globe, so their remains serve as sufficient criteria for the correlation of the strata which contain them. The sequence of life forms once made out gives us, for the whole earth, the means for fixing the order of deposits, even when this is most profoundly disarranged by foldings of the strata into mountains or by other earth movements.